FORM PTO-1390 MODIFIED	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 2380-1599
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) **To be assigned**
INTERNATIONAL APPLICATION NO. **PCT/SE2010/051355**	INTERNATIONAL FILING DATE **9 December 2010**	PRIORITY DATE CLAIMED **4 October 2010**

TITLE OF INVENTION

MINIMIZING DRIVE TEST LOGGED DATA REPORTING

APPLICANT(S) FOR DO/EO/US

PERSSON et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a submission under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a submission under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The U.S. has been elected (Article 31).
5. A copy of the International Application as filed (35 U.S.C. 371(c)(2).
   a. ☒ is attached hereto (23 pages including specification, claims (30 claims), abstract; and 5 sheets drawings).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(3))
   a. ☐ is attached hereto (pages specification, claims & abstract (claims), sheets drawings, page Certificate of Translation).
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has **NOT** expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3).
9. a. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4).
   b. ☐ Declaration was submitted to the International Bureau during International Phase (see copies of Declaration (page Form PCT/RO/101 and Form PCT/IB/371 and first page of printed publication acknowledging receipt thereof attached).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5).

Items 11 To 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.
13. a. ☒ A FIRST preliminary amendment.
    b. ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ An Application Data Sheet under 37 C.F.R. § 1.76.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 37 CFR 1.821-1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☐ Other items or information.

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U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
To be assigned	**PCT/SE2010/051355**	**2380-1599**

☐ The following fees are submitted:

BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5):			
21. ☒ Basic national fee ..... $330.00 (1631)/$165.00 (2631)	$	330.00	
22. ☒ Examination Fee ..... $0.00 (1643/2643) ..... $220.00 (1633)/$110.00 (2633)	$	220.00	
23. ☒ Search Fee .....$0.00 (1640/2640) ..... $100.00 (1641)/$50.00 (2641) ..... $430.00 (1642)/$215.00205 (2642) ..... $540.00 (1632)/$270.00 (2632)	$	430.00	
TOTAL OF ABOVE CALCULATIONS	$	980.00	

☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing or computer program listing filed in an electronic medium). The fee is $270.00 for each additional 50 sheets of paper or fraction thereof.

Total Sheets		Extra Sheets		Number of each additional 50 or fraction thereof (round **up** to a whole number)		RATE		
28	-100	0	/50 =	0.00		**$0.00** (1681) **$0.00** (2681)	$	0.00

Surcharge of **$130.00** (1617)/**$65.00** (2617) for furnishing the oath or declaration later than ☒ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e).							$	130.00
CLAIMS	NUMBER FILED		# EXTRA	RATE				
Total Claims	30	minus 20 =	10 X	$52.00 (1615)/	$26.00 (2615)		$	520.00
Independent Claims	4	minus 3 =	1 X	$220.00 (1614)	$110.00 (2614)		$	220.00
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)				$390.00 (1616)/$195.00 (2616)			$	0.00
Petition is hereby made to extend the current due date so as to cover the filing date of this paper and attachment(s): One Month Extension $130.00 (1251)/$65.00 (2251); Two Month Extension $490.00 (1252)/$245.00 (2252);Three Month Extension $1110.00 (1253/$555.00 (2253); Four Month Extension $1730.00 (1254/$865.00 (2254)							$	0.00
☐ Applicant claims small entity status. See 37 CFR 1.27.								
Processing fee of **$130.00** (1618), for furnishing the English Translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(f).						+		0.00
						TOTAL NATIONAL FEE =	$	**1850.00**
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). **$40.00** (8021) per property						+	$	0.00
Fee for Petition to Revive Unintentionally Abandoned Application;**$1620.00** (1453) / **$810.00** (2453)							$	0.00
						TOTAL FEES ENCLOSED =	$	**1850.00**
							Amount to be: refunded:	$
U.S. Application No. To be assigned; Atty Docket No. 2380-1599							Amount to be Charged:	$

a. ☐ A check in the amount of $1850.00 to cover the above fees is enclosed.
b. ☐ Please charge my Deposit Account No. 14-1140 in the amount of $_____ to cover the above fees.
c. ☒ The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140. **However, authorization is NOT given hereby to charge any extra claims fee or multiple dependent claims fees.**
d. ☒ **CREDIT CARD PAYMENT.**
e. ☒ The entire content of International Application No. **PCT/SE2010/051355** and **U.S. Provisional No. 61/389,581**, referred to in this application are hereby incorporated by reference.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b) must be filed and granted to restore the application to pending status.

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REGISTRATION NUMBER Date

1735448

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

PERSSON et al. Atty. Ref.: 2380-1599

National Phase of PCT/SE2010/051355
International Filing Date: 9 December 2010

Appl. No. To be assigned TC/A.U. To be assigned

Filed: December 28, 2010 Examiner: To be assigned

For: MINIMIZING DRIVE TEST LOGGED DATA REPORTING

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December 28, 2010

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

PRELIMINARY AMENDMENT

In order to place the above-identified application in better condition for examination, please amend the application as follows:

1735433

REMARKS

The title has been amended and the specification has been amended to include a cross-reference to the parent PCT application.

Claims 1-30 are the pending claims in the present application. The claims have been amended, without prejudice, to eliminate a multiple dependencies to reduce claims fees and/to conform US patent practice.

Respectfully submitted,

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NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK

TECHNICAL FIELD

This disclosure pertains to a method in a network node, a method in user equipment, a network node and user equipment in a wireless communications network. More particularly, there is provided mechanisms for network based control of report messages comprising logged measurements in a wireless communications network.

BACKGROUND

In a typical cellular radio system, wireless terminals, also known as mobile stations and/or User Equipments units (UEs), communicate via a Radio Access Network (RAN) to one or more core networks. The wireless terminals, hereinafter called UEs which is the same as User Equipments, can also be mobile telephones, i.e. "cellular" telephones, and laptops with wireless capability e.g., mobile termination, and thus are, for example, portable, pocket, hand-held, computer-included, or car-mounted mobile devices which communicate voice and/or data via the RAN.

The RAN normally covers a geographical area which is divided into cell areas, also denoted cells, with each cell area being served by a base station e.g., a Radio Base Station (RBS), which in some networks is also called "NodeB" or "B node". A cell is a geographical area where radio coverage is provided by base station equipment at a base station site. Each cell is identified by an identity within the local radio area, which is broadcast in the cell. The base station communicates over the air interface operating on radio frequencies with the UEs within range of the base stations.

In some versions, particularly earlier versions of the RAN, several base stations are typically connected, e.g., by landlines or microwave, to a Radio Network Controller (RNC). The RNC, also sometimes termed a Base Station Controller (BSC), supervises and coordinates various activities of the plural base stations connected thereto. The radio network controllers are typically connected to one or more core networks.

The Universal Mobile Telecommunications System (UMTS) is a third generation mobile communication system, which evolved from the Global System for Mobile Communications

(GSM), and is intended to provide improved mobile communication services based on Wideband Code Division Multiple Access (WCDMA) access technology. UTRAN is essentially a radio access network using wideband code division multiple access for user equipment units (UEs). The Third Generation Partnership Project (3GPP) has undertaken to evolve further the UTRAN and GSM based radio access network technologies.

Long Term Evolution (LTE) is a variant of a 3GPP radio access technology wherein the radio base station nodes are connected directly to a core network rather than to RNCs. In general, in LTE the functions of the RNC node are performed by the RBSs. As such, the RAN of an LTE system has an essentially "flat" architecture comprising RBSs without reporting to RNCs. In LTE networks the base station(s) is/are called eNodeB(s) or eNB(s).

3GPP is in the process of defining solutions for Minimizing Drive Tests (MDT). The intention of the Minimizing Drive Tests (MDT) work is documented in 3GPP TR 36.805 V9.0.0 (2009-12), 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on Minimization of drive-tests in Next Generation Networks (Release 9).

Stage 2 of Minimizing Drive Tests (MDT) is currently being developed in TS 37.320, i.e., 3GPP TS 37.320, "Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2". MDT Stage 2 includes a UE measurement logging function and immediate reporting function. The 3GPP TS 37.320 document essentially focuses on the UE measurement logging function.

An important use case for MDT is coverage optimization. For this purpose following UE measurements, or similar functionalities, are considered for UE-internal logging: Periodic, e.g. one every 5s, downlink pilot signal strength measurements; a serving cell becomes worse than threshold; transmit power headroom becomes less than threshold; Paging Channel Failure i.e. Paging Control CHannel (PCCH) decode error; and Broadcast Channel failure.

The network can request the UE to perform logging of measurements. The UE executes measurements and logs these measurements internally in a sequential manner, containing, e.g., some hour of logged measurement information.

As described in Fig. 1, the UE indicates to the network if it has available log i.e. available logged measurements. The network node i.e. eNB/RNC determines if it should request the logged measurements or not. If it decides to do so then a request is sent to the UE to deliver the

log in a report message. From the eNB/RNC, the reported logged measurements may further be sent to an OAM server or similar.

The current 3GPP assumptions on this log (i.e. logged measurements) feature are, e.g., as follows: the UE is required to maintain only one log at a time; one log only contains measurement information collected in one Radio Access Technology (RAT); a log can only be reported and indicated when the UE is in connected state; If UE is requested to start logging, e.g., by configuration, a possibly old log and configuration stored in UE is erased.

What the logged measurement report message in signal number 4 in Fig. 1 should look like has not yet been decided, as of the filing of this application. Some proposals for management of measurement report have been proffered.

As one example proposal for management of measurement reports, it has been suggested that a log i.e. logged measurements, are to be sent in a single packet, and keeping that single packet within the size limits of a Packet Data Convergence Protocol (PDCP) Protocol Data Unit (PDU). Keeping the single packet within the size limits of a PDCP PDU makes it possible to use a Radio Resource Control RRC message for reporting without being segmented into several smaller packets before being sent to the receiving node i.e., the eNB or NB/RNC in LTE or UMTS, respectively. One option of this proposal would be limiting the maximum size of a log in a UE to one RRC message that fits into one PDCP payload packet.

As another example proposal for management of measurement reports, it has been suggested to send a log i.e. a logged measurement that is larger than a RRC message with several RRC messages.

However, there are disadvantages to both example proposals mentioned above. For example, limiting the log size could prevent logging to complete for the whole configured run time i.e. logging duration, which can be several hours. The log could fill the limited log buffer in the UE before any measurement report has been possible to send to the network node. Before the configured logging duration time has ended, the UE would stop the logging so that to only allow the log size to be a single packet e.g. single RRC packet, and relevant measurements reports may not thereafter be logged. Also in the current MDT configuration a start time for the logging is not configurable. This means that for a prolonged logging campaign a long period between logging instances may be needed in the MDT configuration, alternatively new MDT

configuration needs to be provided from the OAM periodically to be conveyed to MDT capable UEs.

For the other proposal, sending too many RRC packets in a row could, in poor radio environments or when handover would occur, create problems with the radio connections and could also create unnecessary radio link failures that will make the users suffer and logged data be lost.

SUMMARY

The technology disclosed herein concerns network based control of report messages comprising logged measurements in a wireless communications network, which overcomes at least some of the above mentioned disadvantages and which allows multiple partial report messages to be sent.

In accordance with some example embodiments, a UE that has stored logged data i.e. logged measurements that are bigger than a single transmission packet, i.e. report message, segments the data and sends only a portion of the data that fits into a single report message, and also indicates that more logged measurements exists at the UE.

In a first example of embodiment, there is disclosed a method in a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The method comprises sending a request to the UE to start transmitting logged measurements in a report message. The network node then receives the report message comprising the logged measurements from the UE, and determines if the received report message comprises an indicator of additional logged measurements not yet transmitted, and if so, decides if the additional logged measurements need to be requested.

In a second example of an embodiment there is disclosed a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The network node comprises a network node communications interface and a network node processor circuit. The network node communications interface being configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements. The network node

processor circuit being configured to determine if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, to decide if the additional logged measurements need to be requested.

In a third example of an embodiment, there is disclosed a method in a User Equipment, UE, for assisting in network based control of report messages in a wireless communications network. The UE is being in connection with a serving network node and configured to transmit report messages to the network node upon request. The UE is further configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer as logged measurements. The method comprising: receiving a request, in the UE, from the network node to start transmitting logged measurements in a report message; determining if the logged measurements fit in the report message; and if not, including in the report message an indicator of additional logged measurements not yet transmitted; and, transmitting the report message, comprising the indicator, to the network node as a response to the request.

In a fourth example of an embodiment, there is disclosed a User Equipment, UE, for assisting in a network based control of report messages in a wireless communications network. The UE is being in connection with a serving network node and is configured to transmit report messages to the network node. The UE is further configured to periodically perform radio condition measurements and store the periodically performed measurements in a buffer as logged measurements. The UE comprises a UE communications interface and a UE processor circuit. The UE communications interface is configured to receive a request from the network node to start transmitting logged measurements in a report message, and to transmit the report message comprising the logged measurements. The UE processor circuit is configured to determine if the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

An advantage achieved by some of the above mentioned embodiments is that due to use of indicator in report message of further remaining logged measurements providing the network, i.e. a network node, with information needed to decide a timing of transmission of the logged measurements and a timing of when more logged measurements should be requested.

Another advantage achieved by at least some of the above mentioned embodiments is to make it possible to have longer logging duration and/or conduct more frequent measurements without overflow in log memory in UE e.g. UE buffer.

Another advantage achieved by some of the above mentioned embodiments is to provide the network node with information about logged measurements making it possible to determine the amount of logged measurements kept in a UE.

The foregoing and other objects, features, and advantages will become apparent from following more particular descriptions of preferred embodiments and aspects of embodiments as will be illustrated by accompanying drawings in which reference characters refer to the same parts throughout various views.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings are not necessarily to scale, emphasis instead being placed upon illustrating principles of the disclosure.

Fig. 1 is a signaling scheme illustrating how logged measurements are reported according to prior art.

Fig. 2 is a schematic block diagram illustrating example embodiments of a network node and a user equipment.

Fig. 3 is a flowchart depicting an example embodiment of a method in a network node.

Fig. 4 is a flowchart depicting further example embodiments of a method in a network node.

Fig. 5 is a flowchart depicting an example embodiment of a method in a user equipment.

Fig. 6 is a flowchart depicting further example embodiments of a method in a network node.

DETAILED DESCRIPTION

Fig. 2 illustrates portions of an example embodiment of a communications system/network, and particularly portions of a Radio Access Network (RAN) **20** comprising at least one network node **28** and a wireless terminal, hereinafter denoted User Equipment, (UE) **30**. Depending on a particular type of RAN utilized and delegation of nodal responsibilities, the

network node 28 may be a base station node e.g., an NodeB in UMTS or an eNodeB in Long Term Evolution (LTE)) or a Radio Network Controller (RNC) node in UMTS. Thus, the UE 30 communicates over radio interface **32** with the network node 28, either directly over radio interface 32 with the network node 28 in case of the network node 28 being a base station type node, or over the radio interface 32 and through a base station in the case of the network node 28 being a radio network controller (RNC) node or an Mobility Management Entity (MME) which is a control node which processes signaling between the UE and the Core Network (CN) and provides Visitor Location Register (VLR) functionality for the Evolved Packet System (EPS).

As mentioned above, the UE 30 can be a mobile station such as a mobile telephone ("cellular" telephone) or laptop with wireless capability (e.g., mobile termination), and thus can be, for example, a portable, pocket, hand-held, computer-included, or car-mounted mobile device which communicates voice and/or data via radio access network.

In accordance with one of its aspect, the technology disclosed concerns generation and/or transmission and/or use of multiple partial report messages with logged measurements such as MDT log packets, also denoted MDT log or MDT log data. As such, Fig. 2 shows an example embodiment of network node 28 or UE 30, which comprises a UE communication interface **42** and a UE processor circuit **40**. Note that the UE may be seen as a serving point. The UE processor circuit may include a buffer **44**, i.e. UE buffer, for storing logged measurements, not shown in figure, and in another embodiment the buffer 44 is within the UE 30.

Fig. 2 also illustrates network node 28 as comprising a network node processor circuit **50** and network node communications interface **52** (i.e. a communications interface of the network node). The network node processor circuit 50 may be, or comprise, a logged measurements requestor/processor (not shown in figure) to be used for requesting logged measurements, such as MDT log, in report message(s).

According to one example of an embodiment, the network node 28 is used for network based control of report messages comprising logged measurements in a wireless communications network, the network node 28 being configured to serve the UE 30, UE, and to receive report messages from the UE 30.

Continuing with the description of Fig. 2, the network node communications interface 52 is, or may be, configured to send request(s) to the UE 30 to start transmitting logged measurement(s) in report message(s), and to receive the report message(s) comprising the logged measurements. The logged measurements may comprise one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

According to one embodiment, the network node communications interface 52 may be configured to receive, from the UE 30, an indication of existents of logged measurements that are available. Note, that the "additional logged measurements" indicator is conveyed in the UE information report message while the indication of logged measurements available is conveyed in already existing/specified signaling.

According to one embodiment, the network node communications interface 52 may be configured to request the report message(s) directly from the UE 30 or from another network node, e.g. RNC, MME, RBS or other similar node.

According to one embodiment, the network node communications interface 52 may be configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node. The request may for example be a RRC connection request. The network node communications interface 52 may also be configured to receive a network node message from the other network node i.e. another eNodeB, RNC or RBS, comprising UE specific information. The UE specific information may further comprise the indicator indicating additional logged measurements not yet transmitted.

The network node processor circuit 50, mentioned above in relation to Fig.2, is configured to determine if the received report message(s) comprises an indicator of additional logged measurement(s) not yet transmitted; and if so, to decide if the additional logged measurements need to be requested. According to one embodiment, the network node processor circuit 50 may be configured to decide if the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc.

According to one embodiment, the network node processor circuit 50 may be configured to determine if the indicator indicates that there are logged measurements in a UE buffer 44 that do, or do not, fit in a single subsequent report message.

According to one embodiment, the network node processor circuit 50 may be configured to decide to request all the logged measurements in the buffer 44 of the UE in one subsequent request, or repeatedly upon receiving each report message. The decision may also be based on received status information of the buffer 44 in the UE 30 being for example overloaded. Note that configured to or adapted to in relation to functionality of circuits and devices mentioned above and throughout the whole disclosure are expressions that may be used having a similar or same meaning.

It should be appreciated that the network node processor circuit 50 may comprise an MDT log requestor/processor 50' (not shown in Fig. 2) which may be implemented in platform fashion, e.g., implemented by a computer/processor executing instructions of non-transient signals and/or by a circuit.

Likewise from a UE perspective, reference made to Fig. 2, the UE 30 may be, or is, used for assisting in network based control of report messages comprising logged measurements in a wireless communications network. The UE 30 is being in connection with the serving network node 28 and is configured to transmit report message(s) to the network node 30. The UE 30 may further be configured to periodically perform radio condition measurements and store the periodically performed measurements in the buffer 44 as logged measurements. Such logged measurements may be MDT log reports.

The UE communications interface 42 mentioned above in relation to Fig. 2, is configured to receive a request from the network node 28 to start transmitting logged measurements in report message(s), and to transmit/send the report message(s) comprising the logged measurements. The UE processor circuit 40 is configured to determine if the logged measurements fits in the report message(s), and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

According to one embodiment of an example implementation of a UE 30 in which the UE processor circuit 40 may be, or may comprise, a multiple partial MDT log reporter **40'** (Fig. 2 dashed lines). The multiple partial MDT log reporter 40' may comprise a log report generator

and data logging unit (not shown in Fig. 2). The multiple partial MDT log reporter 40' works in conjunction with a measurement unit (not shown in Fig. 2), and stores records of measurements in data logging unit. The log report generator may further comprise a packet identifier generator and "more data" i.e. additional data, flag generator.

The technology disclosed above, and in relation to some of the earlier mentioned embodiments, includes support for logged measurements, or an MDT log size, which exceeds a maximum size of the report message which may for example be a Packet Data Convergence Protocol (PDCP) packet. The technology disclosed herein also introduces and provides an indication from the UE 30 of additional logged measurements or MDT log data that remains in the UE buffer 44. In accordance with some example embodiments, a UE 30 that has stored logged measurements, sometimes denoted logged data, that are bigger than a single report message i.e. transmission packet, segments the logged measurements, and sends only a portion of the logged measurements that fits into a single report message. The UE 30 also indicates that more logged measurements exist at the UE 30 in the buffer 44. This indication of further remaining logged measurements allows the network node 28 to decide a timing of transmission of the logged measurements and a timing of when more logged measurements should be requested. This may for example depend on radio condition measurements or UE buffer status information.

The UE 30 will take a part of the logged measurements and put into the payload of the report message. The UE 30 will, if more logged measurements are still available, set a "more" or "additional" bit indicating to the network node 28, or by other means indicate to the network node 28, that there are more logged measurements available in the UE 30. The network node 28 will then, when it believes more data should be obtained e.g. based on: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc., request more logged measurements. When a request is done then the process may be repeated. A new decision may be taken after a new report message is received, and so on. In other words, upon reception of indication from UE, the network node 28 takes a decision (based on current radio conditions, node capacity) whether the network node 28 shall request more logged measurements "data" from the UE now or request it at a later point in time. This "later point in time" could be predefined e.g. 15s later. In one example an internal algorithm may for instance check to see if no Hand Over (HO) is imminent or other more vital procedure is at hand. The report messages

may be lost if unsuccessfully reporting happens just before a HO. In one example, the network node 28 may be configured to continue requesting reporting of logged measurements (MDT logs) in report messages until there are no more logged measurements to report.

An example of an embodiment of a method that may be implemented in the network node 28 is illustrated by **Fig. 3**. The method is used for network based control of report messages comprising logged measurements in a wireless communications network. According to the method, the network node 28 which is being configured to serve a UE 30, receives report messages from the UE 30 as mentioned above in relation to Fig. 2. More particularly, the method comprises: sending **S62** a request to the UE to start transmitting logged measurements in a report message; receiving **S64** the report message comprising the logged measurements; determining **S66** if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, deciding **S68** if the additional logged measurements need to be requested.

Yet an example of an embodiment of a method for implementation in the network node 28 is illustrated by **Fig. 4**. The general steps i.e. **S72, S74, S76** and **S78** correspond to S62-S68 mentioned above. In this example method comprises the network node 28 first receiving **S71**, e.g. from the UE 30, an indication of existents of logged measurements that are available i.e. the UE buffer 44 is not empty or more data exists in UE buffer 44. Note that this indication is different from the indicator indicating additional logged measurements.

According to the method, the network node 28 decides to send S72 request to the UE 30 to start reporting and receives S74 a report message as a response. The network node 28 then determines if the report message, which also comprises logged measurements and reporting time stamp, comprises an indicator of additional logged measurements not yet reported. If so, the network node 28 may decide S78 to request these additional logged measurements and therefore restarts at S72. If no indicator is included, the network node 28 will await **S77** a new indication S71, and restarts the procedure at S72. The network node 28 upon deciding S78 to request additional logged measurements may decide to request **S79** all logged measurements in one decision instead of requesting one subsequent report message at a time. In some example embodiments, if the UE 30 indicates that more than one reporting message is needed for the logged measurements in its UE buffer 44, several bits may then be used to indicate that. The

network node 28 may then choose to request multiple messages if the network node 28 so wants.

From a UE perspective, and an example of an embodiment which illustrates a method in a UE, reference is now made to **Fig. 5**. The UE 30 is configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer 44 as logged measurements. The method in the UE 30 for assisting in network based control of report messages comprising logged measurements in a wireless communications network, comprises: receiving **S82** a request from the network node 28 to start transmitting logged measurements in a report message; determining **S84** if the logged measurements fit in the report message; and if not, including **S86** in the report message an indicator of additional logged measurements not yet transmitted; and, transmitting **S88** the report message, comprising the indicator, to the network node 28 as a response to the request (S62; S72).

In an example of an embodiment and UE mode, the technology disclosed herein encompasses the following acts and capabilities, as illustrated by **Fig. 6**:

S90: UE periodically performs measurements and logs radio condition measurements, and possibly detailed positioning information of the UE 30, and stores the measurements as logged measurements in the UE buffer 44 i.e. in internal memory of the UE 30.

According to one embodiment the logged measurements in UE buffer 44 may be built up as "records" that include a "time stamp" indicating the time when the radio measurement was taken i.e. “measurement time stamp” and logged measurements. The record may optionally also include detailed position information of the UEs geographical position. The “records” may have variable size. The size of the logged measurements, sometimes denoted log size, in UE buffer 44 may be bigger than is possible to fit into one single report message to be sent from UE to network node.

S92: When the UE 30 receives a request from the network node 28 to start transmitting/reporting logged measurements, the UE 28 takes the number of "records" i.e. logged measurements, from the UE buffer 44 i.e. internal log, typically in the order of storage, that fits into the report message, and “advances” an internal pointer such that next-stored “records” will be included in the next report message next time the UE 30 is requested to report logged measurements.

This step, i.e. S92, may be preceded by that the UE 30 sending **S91** an indication to the network node 28 making it aware of logged measurements that are available at the UE 28.

S94: Upon receiving (S92) a request to start transmitting the UE 30 then determines if the logged measurements fit in a single report message or not.

If the logged measurements fit in one report message then no indicator is added or a dedicated bit for the indicator is left empty i.e. null is sent in that bit. Alternatively, an indication is added giving that no more information is available.

S96: In case the UE 30 has more logged measurements ("records") stored in the UE buffer 44 not yet reported an indicator of "additional logged measurements" i.e. more data exist is included in the report message.

A "Time stamp" value i.e. "Reporting time stamp" or other identifier is added to the report message at report message transmission. Alternatively, instead of including a reporting time stamp into the report message, a sequence number, stepped by one with each report message transmission may be used. Note that this reporting time stamp is different from the measurement time stamp added upon performing and logging the measurement.

S98: The UE 30 then transmits the report message, including oldest logged measurements obtained from UE buffer 44, to the network node 28 as a response to the request. The report message may therefore comprise logged measurements, a reporting time stamp and detailed positioning information of the UE 30.

S99: The UE 30 then deletes the transmitted/reported logged measurements from its buffer, i.e. UE buffer 44, and "advances" an internal pointer such that next-stored "records" will be included in the next report message. After receiving a new request from the network node 28 the UE 30 may then transmit/report logged measurements i.e. repeat steps S92-S99 and include new logged measurements i.e. "records", from the UE buffer 44, according to its internal pointer. Alternatively, or in combination with the reporting, the UE 30 may start again at step S90.

Note, that in current "MDT" general implementation the logging of measurements as logged measurements may only be done when UE is in "idle" state and the sending of logged

measurements (MDT logs) in report messages may only be done when the UE is in "connected" state.

In some example embodiments, if the UE buffer 44 is almost full or if a size limitation is to be reached, the UE 30 may indicate such conditions to the network node 28 during the sending S91 or adding that information during S96 and sending it during S98. The network node 28 may then prioritize the retrieval of logged measurements in order not to stop logging and/or loose logged measurements.

During the repeated sequence of messages between the UE 30 and the network node 28, to convey complete logged measurements from the UE 30 to the network node 28, there may be a need to change cell and/or serving Base Station (BS) e.g. during a handover form a first BS (eNB1; NB1; RNC1; RBS1) to a second BS (eNB1; NB1; RNC1; RBS1).

One way to handle cell change and/or BS change situations is that the UE indicate availability when it is connects to the second BS, e.g. according to S91 of Fig. 6. Thus the UE 30 being served by a first BS (e.g. eNB1) and which has for example sent two report messages to first BS, when performing a handover starts by sending an indication, i.e. sends S91 indication of logged measurements available, to second BS (e.g. eNB2) and then upon request starts reporting to second BS a third report message. Logged measurements that are sent in first and second report messages are generally deleted from UE buffer 44 and therefore not longer available.

A second way, or alternative, to handle this situation is that the information that the first BS (e.g. eNB1) has received with respect to "logged measurements available" as of step S91, is transferred to second BS (e.g. eNB2). The information is transferred based on a request from second BS or automatically, including any related information like trace references, etc. The idea here is to include the "indication" in already existing/specified handover preparation signaling (between eNB1 and eNB2) that is "preparing" the eNB2, before the UE is actually handed over (commanded) from eNB1 to eNB2.

In some situations, "trace references" and "logged measurements available" indication (S91) may be forwarded between RAN 20 nodes. In such cases, the UE 30 may also include the trace references in the report message when the UE 30 transmits a first report message to a RAN

node after handover. Note that this first report message, as of the example mentioned above in relation to the first way of handling the situation, would be the third report message.

Thus, the technology disclosed herein, in one of its aspects, supports and/or facilitates a log size exceeding a maximum size of a reporting message e.g. a PDCP packet. If the reporting loss/performance is considered an issue and needs to be addressed, while a restriction of a UEs total log size, in UE buffer or UE memory, is not wanted, then the UE that has stored logged measurements i.e. logged data, that is bigger than a single payload PDU (e.g due to PDCP restriction) may segment the logged measurements and send only a part that fits into a single report message/packet e.g., a message size in the UE response message has a fixed size while the MDT log itself has another limit e.g. UE buffer size restriction in UE 30 etc. To handle this, an indication in the report message e.g. the UE MDT log report, on that additional/more logged measurements exists is provided. This allows the network node 28 to decide the timing for when measurements should be requested and/or (re-)configured. Relying on the "report available bit" only would require that the UE again transients to RRC connected which may delay the transfer of logged measurements further, possibly involving UE log memory being exhausted, new logged MDT configuration or Hand Over (HO) to other Radio Access Technology (RAT) etc.

Thus, with a report message size restriction, the UE 30 shall be able to partition the logged measurements into a maximum fixed size reporting message e.g. an RRC message.

Currently the RRC message for MDT also carries information for RACH optimization (SON) and other optionally configured information. One consequence of the presence of other information in the RRC message/PDU using a size restriction would be that it possibly depends on the RRC message construction and configuration, or that the maximum size of a report message is always set according to a worst case scenario.

In view of the reasons above, no special handling of the RRC message/log size might be needed as a result of MDT. Retaining normal handling of RRC messages etc simplifies the considerations that need to taken in the network node 28 and UE 30.

The technology disclosed herein affords several advantages. Among the advantages are the following. The technology allows for long logging run times that may create large logged measurements sizes while the network node 28 controls the reporting time. The technology

facilitates that the network node 28 may determine an appropriate time of reporting without loosing logged measurements.

In the above description, for purposes of explanation and not limitation, specific details are set forth such as particular architectures, interfaces, techniques, etc. in order to provide a thorough understanding. However, it will be apparent to those skilled in the art that the above mentioned embodiments may be practiced in a ways that depart from these specific details. That is, those skilled in the art will be able to devise various arrangements which, although not explicitly described or shown herein, embody the principles of the embodiments and are included within their spirit and scope. In some instances, detailed descriptions of well-known devices, circuits, and methods are omitted so as not to obscure the description of the present embodiments with unnecessary detail. All statements herein reciting principles, aspects, and embodiments, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

Thus, for example, it will be appreciated by those skilled in the art that block diagrams of Fig. 2 herein may represent conceptual views of illustrative circuitry or other functional units embodying the principles of the technology. Similarly, it will be appreciated that any flow charts as of Fig. 3- Fig. 6, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

Functions of various elements including functional blocks of Fig. 2, including but not limited to those labeled or described as “computer”, “processor” or “controller”, may be provided through the use of hardware such as circuit hardware and/or hardware capable of executing software in the form of coded instructions stored on computer readable medium. Thus, such functions and illustrated functional blocks are to be understood as being either hardware-implemented and/or computer-implemented, and thus machine-implemented.

In terms of hardware implementation, the functional blocks of network node 28 or UE 30 may include or encompass, without limitation, Digital Signal Processor (DSP) hardware, reduced instruction set processor, hardware (e.g., digital or analog) circuitry including but not limited to

Application Specific Integrated Circuit(s) [ASIC], and (where appropriate) state machines capable of performing such functions.

In terms of computer implementation, a computer is generally understood to comprise one or more processors or one or more controllers, and the terms computer and processor and controller may be employed interchangeably herein. When provided by a computer or processor or controller, the functions may be provided by a single dedicated computer or processor or controller, by a single shared computer or processor or controller, or by a plurality of individual computers or processors or controllers, some of which may be shared or distributed. Moreover, use of the term “processor” or “controller” shall also be construed to refer to other hardware capable of performing such functions and/or executing software, such as the example hardware recited above.

In the example of Fig. 5 the platform depicted by line 70 has been illustrated as computer-implemented or computer-based platform. Another example platform for wireless terminal 70(5) can be that of a hardware circuit, e.g., an application specific integrated circuit (ASIC) wherein circuit elements are structured and operated to perform the various acts described herein.

Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. It will be appreciated that the scope of the present invention fully encompasses other embodiments which may become obvious to those skilled in the art, and that the scope of the present invention is accordingly not to be limited. Reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described embodiments that are known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed hereby. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it to be encompassed hereby.

CLAIMS

1. Method in a network node for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the UE (30), the method comprising:

   - sending (S62) a request to the UE to start transmitting logged measurements in a report message;

   - receiving (S64) the report message comprising logged measurements;

   - determining (S66) if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so,

   - deciding (S68) if the additional logged measurements are to be requested.

2. The method according to claim 1, wherein the method comprises receiving (S71), from the UE, an indication of existents of logged measurements that are available.

3. The method according to any of claims 1 or 2, wherein the logged measurements comprises one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); and broadcast channel failure(s).

4. The method according to any preceding claim, wherein the report message is received directly from the UE or via another network node.

5. The method according to any preceding claim, wherein the deciding (S68) is based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc.

6. The method according to any preceding claim, wherein the determining (S66) comprises determining if the indicator indicates that there is logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

7. The method according to claim 6, wherein the deciding (S68) comprises deciding (S79) to request all the logged measurements in the buffer of the UE in one subsequent request.

8. The method according to any preceding claim, wherein the method comprises receiving a previously sent report message from another network node(s), automatically or upon request.

9. The method according to any preceding claim, wherein the sending of a request is initiated by a UE handover procedure from another network node to the network node.

10. The method according to claim 9, wherein the method comprises receiving a network node message from the other network node comprising UE specific information.

11. The method according to claim 10, wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

12. A network node (28) for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the user equipment (30), the network node comprises:

- a network node communications interface (52) configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements;

- a network node processor circuit (50) configured to determine if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, to decide if the additional logged measurements need to be requested.

13. The network node (28) according to claim 12, wherein the network node communications interface (52) is configured to receive, from the UE, an indication of an existents of logged measurements that are available.

14. The network node (28) according to any of claims 12 or 13, wherein the logged measurements comprises one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit

power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

15. The network node (28) according to any of claims 12 to 14, wherein the network node communications interface (52) is configured to request the report message directly from the UE or from another network node.

16. The network node (28) according to any of claims 12 to 15, wherein the network node processor circuit (50) is configured to decide if the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc..

17. The network node (28) according to any of claims 12 to 16, wherein the network node processor circuit (50) is configured to the determine if the indicator indicates that there is logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

18. The network node (28) according to claim 17, wherein the network node processor circuit (50) is configured to decide to request all the logged measurements in the buffer (44) of the UE in one subsequent request.

19. The network node (28) according to any of claims 12 to 18, wherein the network node communications interface (52) is configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node.

20. The network node (28) according to claim 19, wherein the network node communications interface (52) is configured to receive a network node message from the other network node comprising UE specific information.

21. The network node (28) according to claim 19 wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

22. Method in a User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a

serving network node (28) and configured to transmit report messages to the network node (30) upon request, and wherein the UE (30) is configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer (44) as logged measurements, the method comprising:

- receiving (S82) a request from the network node (28) to start transmitting logged measurements in a report message;
- determining (S84) if the logged measurements fit in the report message; and if not,
- including (S86) in the report message an indicator of additional logged measurements not yet transmitted; and,
- transmitting (S88) the report message, comprising the indicator, to the network node (28) as a response to the request.

23. The method according to claim 22, wherein the including comprises including a reporting time stamp in the report message.

24. The method according to any of claims 22 or 23, wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

25. The method according to any of claims 22 to 24, wherein the logged measurements that are oldest in the buffer are reported first.

26. A User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a serving network node (28) and configured to transmit report messages to the network node (30), and wherein the UE (30) is configured to periodically perform radio condition measurements and store the periodically performed measurements in a buffer as logged measurements, the UE (30) comprises:

- a UE communications interface (42) configured to receive a request from the network node (28) to start transmitting logged measurements in a report message, and to transmit the report message comprising the logged measurements;

- a UE processor circuit (40) configured to determine if the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

27. The User Equipment (30) according to claim 26, wherein the UE processor circuit (40) is configured to add a reporting time stamp to the reporting message.

28. The User Equipment (30) according to any of claims 26 or 27 wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

29. The User Equipment (30) according to any of claims 26 to 28, wherein the logged measurements that are oldest in the buffer are transmitted first.

30. The User equipment (30) according to any of claims 26 to 29, wherein the logged measurements are Minimizing Drive Tests, MDT, log data.

ABSTRACT

This disclosure pertains to a method in a network node, a method in user equipment, a network node and user equipment in a wireless communications network. More particularly, there is provided methods and platforms for network based control of report messages comprising logged measurements in a wireless communications network. In accordance with some example embodiments, a UE (30) that has stored logged data i.e. logged measurements that are bigger than a single transmission packet, i.e. report message, segments the logged measurements and sends only a portion of the logged measurements that fits into a single report message. The UE (30) also indicates to a network node (28) that additional logged measurements exist at the UE buffer (44).

(For publication Fig. 3)

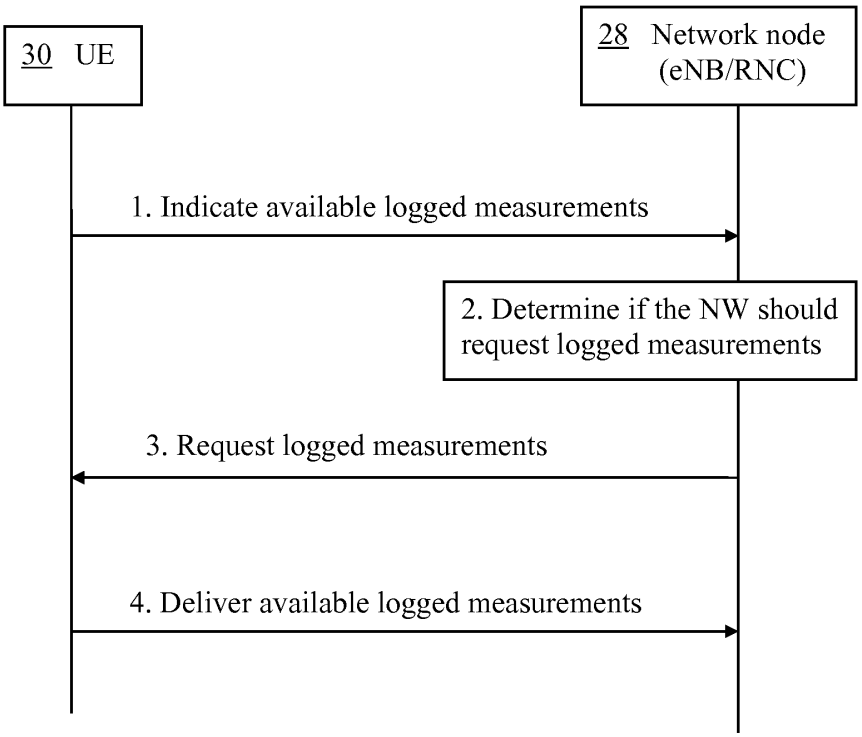

Fig. 1 (Prior art)

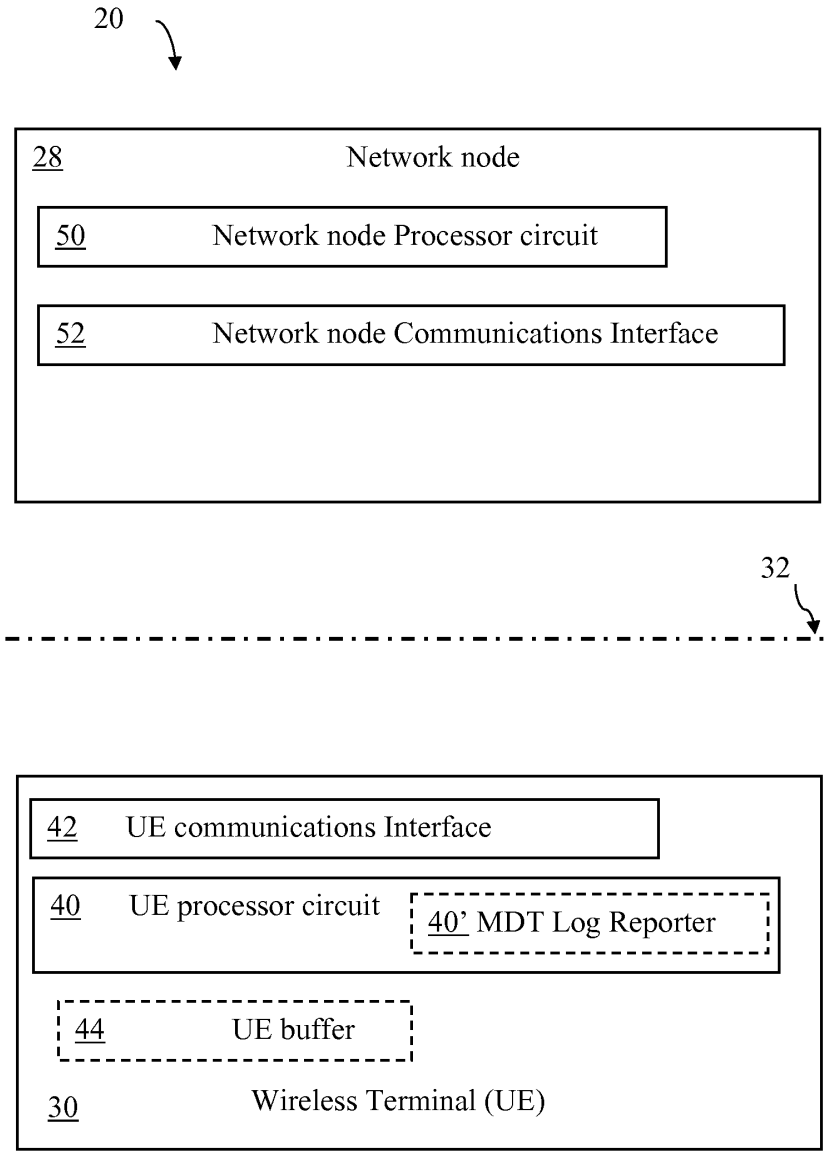
20
28
Network node
50
Network node Processor circuit
52
Network node Communications Interface
32
42
UE communications Interface
40
UE processor circuit
40' MDT Log Reporter
44
UE buffer
30
Wireless Terminal (UE)

Fig. 2

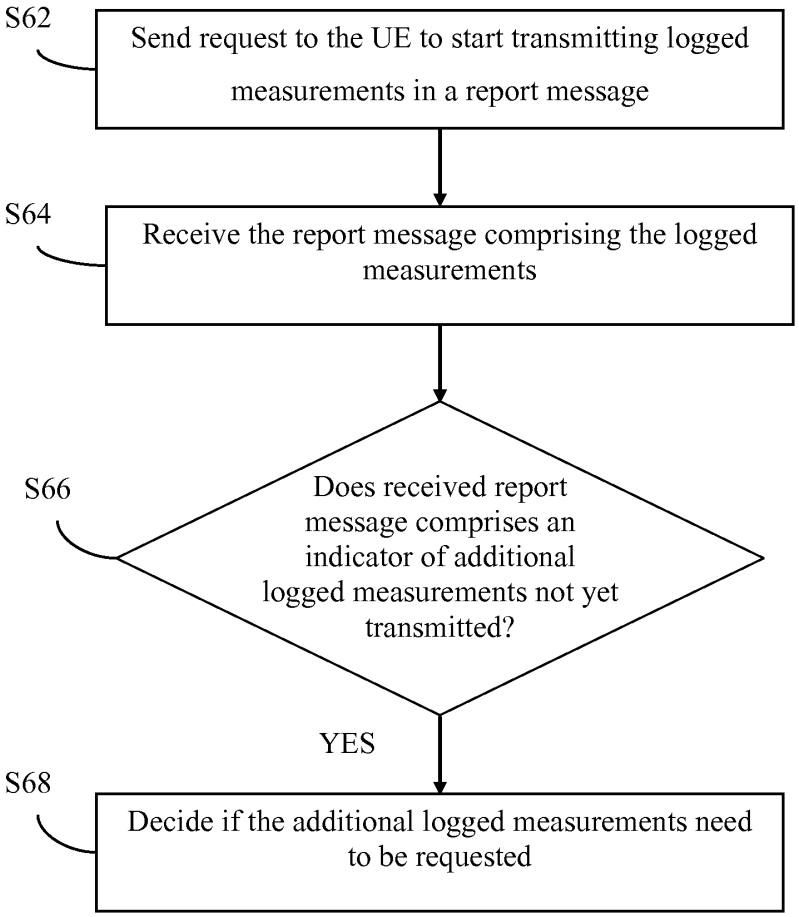
S62
Send request to the UE to start transmitting logged measurements in a report message
S64
Receive the report message comprising the logged measurements
S66
Does received report message comprises an indicator of additional logged measurements not yet transmitted?
YES
S68
Decide if the additional logged measurements need to be requested

Fig. 3

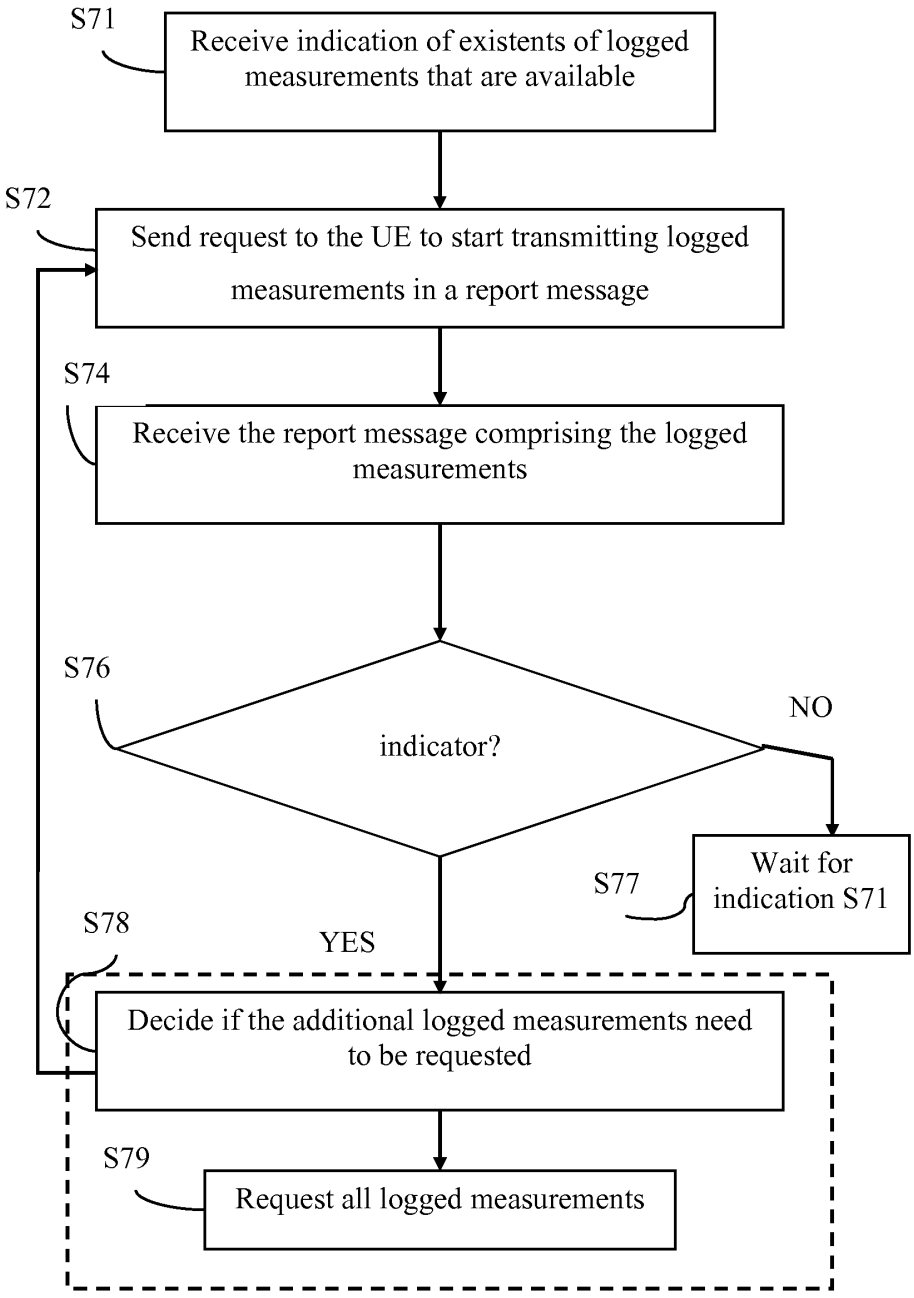
S71
Receive indication of existents of logged measurements that are available
S72
Send request to the UE to start transmitting logged measurements in a report message
S74
Receive the report message comprising the logged measurements
S76
indicator?
NO
S77
Wait for indication S71
S78
YES
Decide if the additional logged measurements need to be requested
S79
Request all logged measurements

Fig. 4

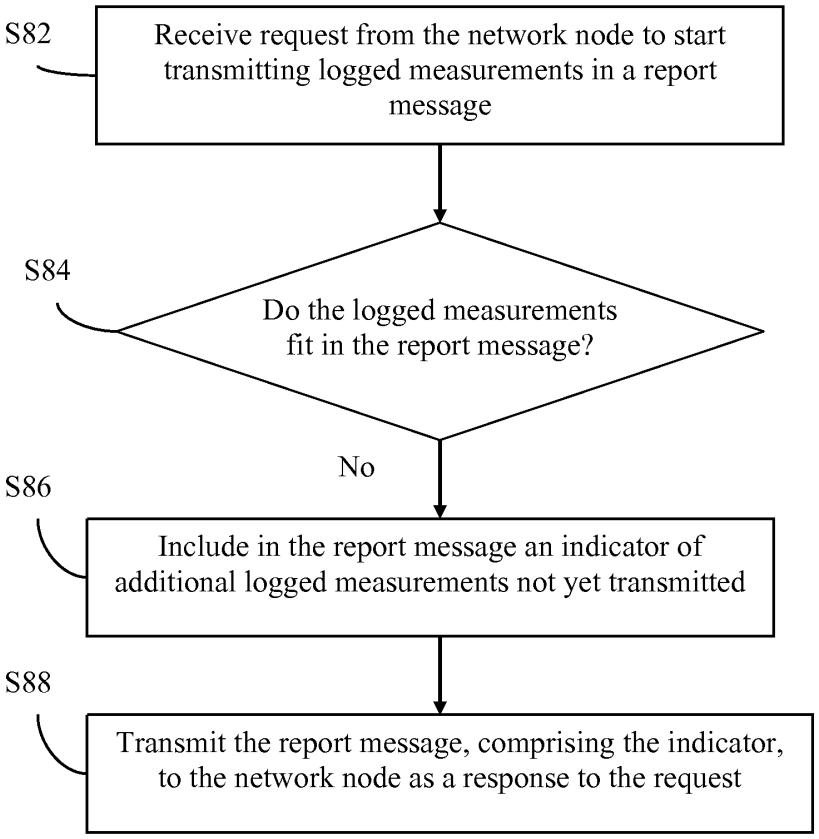
S82
Receive request from the network node to start transmitting logged measurements in a report message
S84
Do the logged measurements fit in the report message?
No
S86
Include in the report message an indicator of additional logged measurements not yet transmitted
S88
Transmit the report message, comprising the indicator, to the network node as a response to the request

Fig. 5

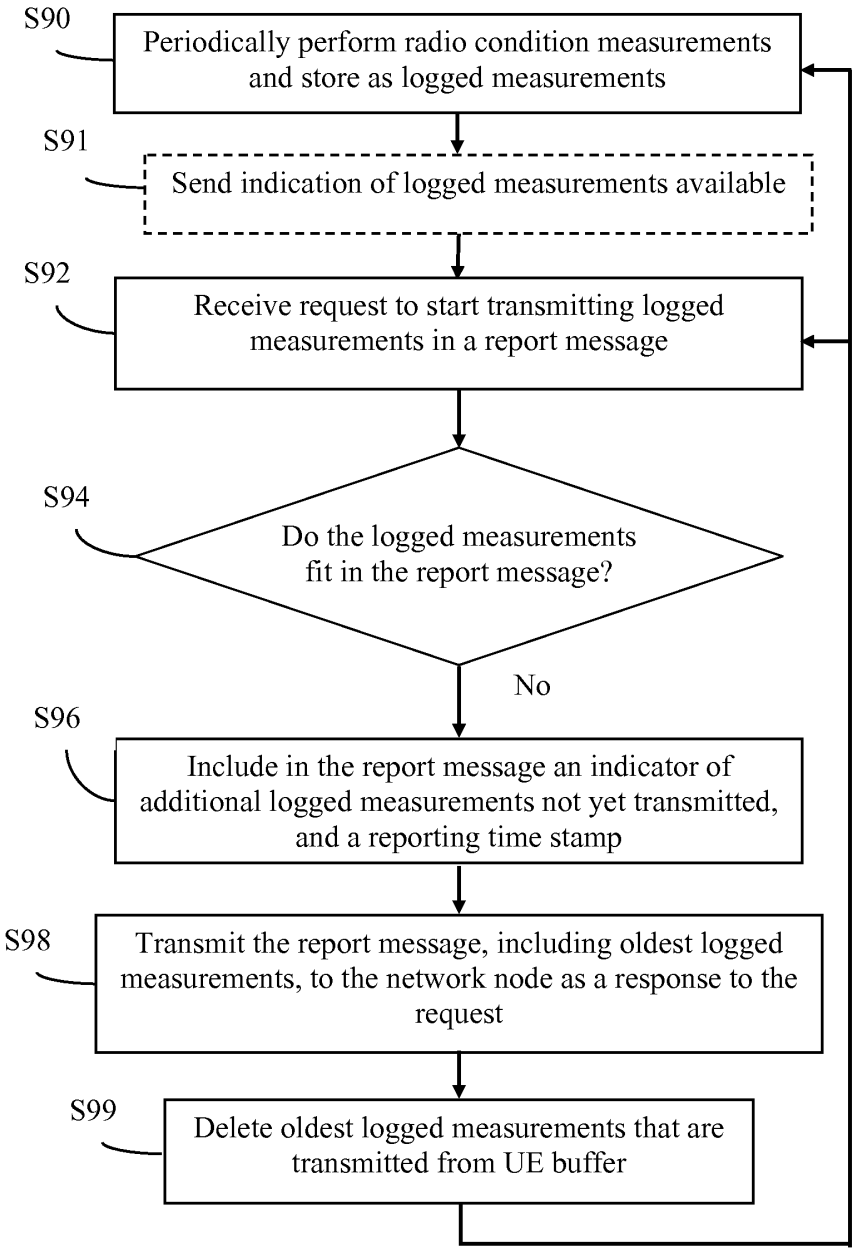
S90
Periodically perform radio condition measurements and store as logged measurements
S91
Send indication of logged measurements available
S92
Receive request to start transmitting logged measurements in a report message
S94
Do the logged measurements fit in the report message?
No
S96
Include in the report message an indicator of additional logged measurements not yet transmitted, and a reporting time stamp
S98
Transmit the report message, including oldest logged measurements, to the network node as a response to the request
S99
Delete oldest logged measurements that are transmitted from UE buffer

Fig. 6

Electronic Patent Application Fee Transmittal	
Application Number:	
Filing Date:	
Title of Invention:	MINIMIZING DRIVE TEST LOGGED DATA REPORTING
First Named Inventor/Applicant Name:	Hakan PERSSON
Filer:	H. Warren Burnam/Carla Gorham
Attorney Docket Number:	2380-1599
Filed as Large Entity	

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
National Stage Fee	1631	1	330	330
Natl Stage Search Fee - Report provided	1642	1	430	430
National Stage Exam - all other cases	1633	1	220	220
Pages:				
Claims:				
Claims in excess of 20	1615	10	52	520
Independent claims in excess of 3	1614	1	220	220
Miscellaneous-Filing:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Oath/decl > 30 months from priority date	1617	1	130	130
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1850**

Electronic Acknowledgement Receipt	
EFS ID:	9124329
Application Number:	13001687
International Application Number:	PCT/SE10/51355
Confirmation Number:	3427
Title of Invention:	MINIMIZING DRIVE TEST LOGGED DATA REPORTING
First Named Inventor/Applicant Name:	Hakan PERSSON
Customer Number:	23117
Filer:	H. Warren Burnam/Carla Gorham
Filer Authorized By:	H. Warren Burnam
Attorney Docket Number:	2380-1599
Receipt Date:	28-DEC-2010
Filing Date:	
Time Stamp:	14:42:24
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

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Payment Type	Credit Card
Payment was successfully received in RAM	$1850
RAM confirmation Number	777
Deposit Account	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Transmittal of New Application	NATL_PHASE_APPLN_TRANSMITTAL.pdf	170867 bdce4a7bd0e502efd433a12d80754275ebe2b055	no	2
Warnings:					
Information:					
2	Preliminary Amendment	PRELIMINARY_AMENDMENT.pdf	100682 940c59fc83091a450bf8223a5ed551814af19741	no	12
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	Specification		1	17	
	Claims		18	22	
	Abstract		23	23	
Warnings:					
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4	Drawings-only black and white line drawings	PCT_DRAWINGS_AS_FILED.pdf	57468 2db3db2a2caa9306370d3dcc6f526c7b78caf33b	no	6
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Information:					
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Information:					
		Total Files Size (in bytes):	551168		

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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

AMENDMENTS TO THE TITLE:

Please amend the title as follows:

MINIMIZING DRIVE TEST LOGGED DATA REPORTING~~NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK~~

AMENDMENTS TO THE SPECIFICATION:

Page 1, after the title insert the following:

This application is the U.S. national phase of International Application No. PCT/SE2010/051355, filed 9 December 2010, which designated the U.S. and claims the benefit to US Provisional No. 61/389,581, filed 4 October 2010, the entire contents of each of which are hereby incorporated by reference.

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Currently Amended) Method in a network node for network based control of report messages in a wireless communications network, the network node ~~(28)~~ being configured to serve a user equipment ~~(30)~~, UE, and to receive report messages from the UE ~~(30)~~, the method comprising:
   - sending ~~(S62)~~ a request to the UE to start transmitting logged measurements in a report message;
   - receiving ~~(S64)~~ the report message comprising logged measurements;
   - determining ~~(S66)~~ if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so,
   - deciding ~~(S68)~~ if the additional logged measurements are to be requested.
2. (Currently Amended) The method according to claim 1, wherein the method comprises receiving ~~(S71)~~, from the UE, an indication of existents of logged measurements that are available.
3. (Currently Amended) The method according to claim 1 ~~any of claims 1 or 2~~, wherein the logged measurements comprises one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot

signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); and broadcast channel failure(s).

4. (Currently Amended) The method according to claim 1~~any preceding claim~~, wherein the report message is received directly from the UE or via another network node.

5. (Currently Amended) The method according to claim 1~~any preceding claim~~, wherein the deciding ~~(S68)~~ is based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc.

6. (Currently Amended) The method according to claim 1~~any preceding claim~~, wherein the determining ~~(S66)~~ comprises determining if the indicator indicates that there is logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

7. (Currently Amended) The method according to claim 6, wherein the deciding ~~(S68)~~ comprises deciding ~~(S79)~~ to request all the logged measurements in the buffer of the UE in one subsequent request.

8. (Currently Amended) The method according to claim 1~~any preceding claim~~, wherein the method comprises receiving a previously sent report message from another network node(s), automatically or upon request.

9. (Currently Amended) The method according to claim 1~~any preceding claim~~, wherein the sending of a request is initiated by a UE handover procedure from another network node to the network node.

10. (Original) The method according to claim 9, wherein the method comprises receiving a network node message from the other network node comprising UE specific information.

11. (Original) The method according to claim 10, wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

12. (Currently Amended) A network node~~ (28)~~ for network based control of report messages in a wireless communications network, the network node~~ (28)~~ being configured to serve a user equipment~~ (30)~~, UE, and to receive report messages from the user equipment~~ (30)~~, the network node comprises:

- a network node communications interface~~ (52)~~ configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements;
- a network node processor circuit~~ (50)~~ configured to determine if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, to decide if the additional logged measurements need to be requested.

13. (Currently Amended) The network node ~~(28)~~ according to claim 12, wherein the network node communications interface ~~(52)~~ is configured to receive, from the UE, an indication of an existents of logged measurements that are available.

14. (Currently Amended) The network node ~~(28)~~ according to claim 12~~any of claims 12 or 13~~, wherein the logged measurements comprises one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

15. (Currently Amended) The network node ~~(28)~~ according to claim 12~~any of claims 12 to 14~~, wherein the network node communications interface ~~(52)~~ is configured to request the report message directly from the UE or from another network node.

16. (Currently Amended) The network node ~~(28)~~ according to claim 12~~any of claims 12 to 15~~, wherein the network node processor circuit ~~(50)~~ is configured to decide if the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc.

17. (Currently Amended) The network node ~~(28)~~ according to claim 12 ~~any of claims 12 to 16~~, wherein the network node processor circuit ~~(50)~~ is configured to the determine if the indicator indicates that there is logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

18. (Currently Amended) The network node ~~(28)~~ according to claim 17, wherein the network node processor circuit ~~(50)~~ is configured to decide to request all the logged measurements in the buffer ~~(44)~~ of the UE in one subsequent request.

19. (Currently Amended) The network node ~~(28)~~ according to claim 12 ~~any of claims 12 to 18~~, wherein the network node communications interface ~~(52)~~ is configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node.

20. (Currently Amended) The network node ~~(28)~~ according to claim 19, wherein the network node communications interface ~~(52)~~ is configured to receive a network node message from the other network node comprising UE specific information.

21. (Currently Amended) The network node ~~(28)~~ according to claim 19 wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

22. (Currently Amended) Method in a User Equipment ~~(30)~~, UE, for assisting in network based control of report messages in a wireless communications network, the UE ~~(30)~~ being in connection with a serving network node ~~(28)~~ and configured to

transmit report messages to the network node ~~(30)~~ upon request, and wherein the UE ~~(30)~~ is configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer ~~(44)~~ as logged measurements, the method comprising:

- receiving ~~(S82)~~ a request from the network node ~~(28)~~ to start transmitting logged measurements in a report message;
- determining ~~(S84)~~ if the logged measurements fit in the report message; and if not,
- including ~~(S86)~~ in the report message an indicator of additional logged measurements not yet transmitted; and,
- transmitting ~~(S88)~~ the report message, comprising the indicator, to the network node ~~(28)~~ as a response to the request.

23. (Original) The method according to claim 22, wherein the including comprises including a reporting time stamp in the report message.

24. (Currently Amended) The method according to claim 22~~any of claims 22 or 23~~, wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

25. (Currently Amended) The method according to claim 22~~any of claims 22 to 24~~, wherein the logged measurements that are oldest in the buffer are reported first.

26. (Currently Amended) A User Equipment ~~(30)~~, UE, for assisting in network based control of report messages in a wireless communications network, the UE ~~(30)~~ being in connection with a serving network node ~~(28)~~ and configured to transmit report messages to the network node ~~(30)~~, and wherein the UE ~~(30)~~ is configured to periodically perform radio condition measurements and store the periodically performed measurements in a buffer as logged measurements, the UE ~~(30)~~ comprises:

- a UE communications interface ~~(42)~~ configured to receive a request from the network node ~~(28)~~ to start transmitting logged measurements in a report message, and to transmit the report message comprising the logged measurements;
- a UE processor circuit ~~(40)~~ configured to determine if the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

27. (Currently Amended) The User Equipment ~~(30)~~ according to claim 26, wherein the UE processor circuit ~~(40)~~ is configured to add a reporting time stamp to the reporting message.

28. (Currently Amended) The User Equipment ~~(30)~~ according to claim 26~~any of claims 26 or 27~~ wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

29. (Currently Amended) The User Equipment ~~(30)~~ according to claim 26 ~~any of claims 26 to 28~~, wherein the logged measurements that are oldest in the buffer are transmitted first.

30. (Currently Amended) The User equipment ~~(30)~~ according to claim 26 ~~any of claims 26 to 29~~, wherein the logged measurements are Minimizing Drive Tests, MDT, log data.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P32817WO1	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/SE2010/051355	International filing date *(day/month/year)* 09.12.2010	Priority date *(day/month/year)* 04.10.2010
International Patent Classification (IPC) or national classification and IPC INV. H04W24/10		
Applicant Telefonaktiebolaget L M Ericsson (publ)		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 9 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 14 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions).
      ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2).
      ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)).
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3*bis* of Annex C of the Administrative Instructions).

4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☒ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☒ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☒ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
03.08.2012	21.12.2012
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	Authorized officer Pasini, Enrico Telephone No. +49 89 2399-6968

Form PCT/IPEA/409 (Cover Sheet) (July 2011)

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3(a) and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4(a))
   - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a) and (b))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-3, 5-15	as originally filed
4, 4a, 16, 17	filed with telefax on 16-10-2012

Claims, Numbers

27-30	as originally filed
1-26	filed with telefax on 16-10-2012

Drawings, Sheets

1/6-6/6	as originally filed

   ☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:

5. ☐ This report has been established:
   - ☐ taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
   - ☐ without taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91(Rules 66.4bis and 70.2(e)).

6. ☐ Supplementary international search report(s) from Authority(ies) has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

Box No. II Priority

1. ☐ This report has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:
   - ☐ copy of the earlier application whose priority has been claimed (Rule 66.7(a)).
   - ☐ translation of the earlier application whose priority has been claimed (Rule 66.7(b)).

2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rule 64.1). Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

   see separate sheet

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-26
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-26
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-26
	No:	Claims	

2. Citations and explanations (Rule 70.7):

   see separate sheet

Box No. VI Certain documents cited

1. Certain published documents (Rule 70.10)

   and / or

2. Non-written disclosures (Rule 70.9)

   see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Cited Documents

The following documents are referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1: 3GPP R2-103086

D2: WO 2006 / 016690 A1

D3: 3GPP R2-104813

D4: 3GPP R2-103173

and also

D5 : 3GPP R2-106238 (P doc)

D6 : 3GPP R2-106198 (P doc)

D7 : 3GPP TS.37320 V1.1.0 (P doc)

Re Item I

Basis of the report

1.

The **amendment filed** with the telefax of 16.10.2012 introduces subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT.

Amended claims 18 and 22 define, in a **same** *"report message"* the presence of two **separate** information elements as *"indicator of additional logged measurements"* and *"indicator of a UE buffer state condition"*. From the **original description and claims**, however, it is **only derivable**, directly and unambiguously, that:

a) *"The logged measurements may comprise one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition"*;

b) *"The network node processor circuit... may be configured to decide if the additional logged measurements need to be requested based on...UE buffer state condition"*;

c) *"The network node processor circuit may be configured to decide to request all the logged measurements in the buffer of the UE in one subsequent request, or repeatedly upon receiving each report message. The decision may also be based on received status information of the buffer"*;

d) *"The UE will, if more logged measurements are still available, set a "more" or "additional" bit indicating to the network node or by other means indicate to the network node, that there are more logged measurements available" and "the network node will then, when it believes more data should be obtained e.g. based on: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc."*

I.e. while it is indeed disclosed that retrieval of the additional logged measurements can be based on a *"received buffer state indication"*, there is instead **no indication** from which it is **directly and unambiguously** derivable that this should or might be received in a **same report message** as the *"indicator of additional logged measurements"*, as instead claimed in the **amended claims 18 and 22.**

Re Item VIII

Certain observations on the international application

The **claims** do not meet the requirements of **clarity** (Article 6 PCT) for the following reasons.

1.

Despite the objection under Item I above, the fact that the UE sends *"status information of the buffer"* in addition to the *"additional logged measurements indicator"* represents an **essential feature** of the invention **at the UE side** as defined in **claims 1 and 10** in order to achieve the effect of the invention over the prior-art (see the Applicant's letter page 3 = permit a decision by the network on the retrieval based on UE-related conditions).

Similarly, deciding whether the additional logged measurements are to be requested based, among others, on the *"UE buffer state condition"* has been correctly defined in **claims 1 and 10**. However, in the absence of any corresponding feature defining that this *"buffer state condition"* information is also **received** from the UE by the network node, it is left unclear (Article 6 PCT) how this **decision** can possibly be **achieved**.

Thus, **claims 1 and 10** do not define **all the essential features** of the invention and, in any case, are not clearly (Article 6 PCT) defined in terms of the **same or corresponding special technical features** as defined in **claims 18 and 22**.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.

Document D1 discloses (see in particular paragraphs 2.2. and 5.1.3), according to **the essential features of claim 1** a method in a network node for network based control of report messages in a wireless communications network, the network node being configured to serve a user equipment UE, and to receive report messages from the UE (see in particular paragraphs 2.2 an 5.1.3) the method comprising:

- sending a request to the UE to start transmitting logged measurements in a report message (see in particular 5.1.3: *"measurement reporting is triggered by UE information request message"*);

- receiving the report message comprising logged measurements (see in particular 2.2: "*log transmitted in several segments"* and 5.1.3 *"logged measurement reports")*.

In **D1** (see in particular 2.2) fragmentation of the logged data is applied whereby the log is transmitted in several segments.

Difference: The subject-matter of **claim 1 explicitly defines** determining if **a received message comprises an indicator** of additional logged measurements not yet transmitted; and if so deciding if the additional logged measurements are to be requested based on **an additional condition**: interference, radio condition measurements, available resources, capacity or UE buffer state condition.

Effect / Problem: The **technical effect** and the resulting **problem** of said **difference** is that of providing **a more flexible measurement data mechanism**.

Obviousness: **D1** already clearly indicates the **principles** that a) transmission of the log can be segmented and b) the UE indicates when log data are available. It would be, thus, entirely evident that a **normal implementation option** is to provide an explicit indication, in case of segmentation, that there are still logged data.

However, it appears that the subsequent step of deciding the retrieval of the data **based on this information and the additional conditions** defined in **claim 1** would not be disclosed or derivable from the cited documents. In particular:

D2 discloses (see in particular the abstract and [0023]-[0024]) channel quality measurements stored at mobile terminals wherein the mobile terminals are generating reports. Additional reports refine the channel quality information sent in the first report and a field in the report indicates the mobility grade. The base station deduces from the field mobility grade how many additional reports will follow. However, **D2** does not hint to the retrieval of remaining **already logged** data based on an additional condition.

D3 (see in particular paragraphs 1, 2, 2.1, option 1 & 2) indicates availability of MDT data with one bit and the network can decide to retrieve the data based on this indication. A retrieve bit can be used to retrieve any remaining MDT logged data or the NB may choose not to retrieve the data. However, there is no hint to the retrieval of remaining data based on a corresponding indication and an additional condition as in **claim 1**.

D4 (see in particular pages 1-2) discloses various implementation option, with the hint to retrieval of partial logs of MDT.

Thus, the subject-matter of **claim 1** meets the requirements of the Article 33 PCT.

2.

Similar observations as in V-1 above are applicable to the corresponding subject-matter of **independent claims 18** and, with similar reasoning, to **claims 10 and 22,** relating to the provision of additional logged data **and,** additionally, of buffer state information.

Therefore, the subject-matter of **independent claims 10, 18 and 22 also** meets the requirements of the Article 33 PCT.

Re Item VI

Certain documents cited

1.

Documents **D5, D6, D7** are 3GPP documents published in the priority interval of the present application and they disclose a method for network based control of report messages based on the explicit indication that MDT log data were not completely transferred according to the **same principle** of the present application.

a) **D5** (see in particular paragraph 5.1.1.3 and sub-paragraphs),

b) **D6** (see in particular paragraph 5.1.1.3 and sub-paragraphs),

c) **D7** (see in particular paragraph 5.1.1.3 and sub-paragraphs).

Buffer status reporting, as defined in **claims 18 and 22** (see also Item I above) is normally known in the art. Thus, the disclosure of **any of D4, D5 or D6** would become relevant in respect of the requirements of the Article 33(3) PCT in case the **claimed priority date** of 04.10.2010 turns out not to be **validly claimed**.

Re Item II

Priority

1.

The priority has been considered provisionally valid as the priority document was not yet available to the IPEA at the time of establishment of this written opinion.

August 3, 2012

VIA FAX (+49 89 2399-4465)

European Patent Office
D-80298 Munich
GERMANY
Attention: Enrico Pasini, Authorized Officer

RE: NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK
Applicant: Telefonaktiebolaget LM Ericsson (publ)
PCT Appl.: PCT/SE2010/051355
Filed: 09 December 2010
Our Ref.: P32817WO1
RESPONSE TO WRITTEN OPINION

Dear Sir:

In response to the Written Opinion dated 12 May 2011, Applicant respectfully requests the Examiner to reconsider the claims of this application in view of the amendments and comments set forth below.

Enclosures

- Replacement claim pages numbered 18-22, containing claims 1-26 (renumbered)(in triplicate).
- Replacement description pages numbered 4, 4a, 16, and 17 (in triplicate).

Summary of Written Opinion

The ISA set forth a reasoned statement with regard to claims 1-30 of the patent application. Claims 1-30 were found to lack inventive step in view of Documents D1-D4. Independent claims 1, 12, 22, and 26 were found to lack inventive step in view of Document D1 (3GPP R2-103086) and D2 (WO 2006/016690 A1). The dependent claims were found to lack inventive step in view of D1, D2, D3 (3GPP R2-104813) and D4 (3GPP R2-103173).

Summary of Amendments

Original claims 1-30 have been amended and renumbered as claims 1-26. Substitute pages 18-22 include claims 1-26 as amended and renumbered.

The background section of the description has been amended to add a brief discussion of cited documents D1-D3. Pages 16 and 17 have been amended to delete or rewrite several paragraphs reciting that the invention is not limited by the disclosed embodiments.

Re Item VIII

The Examiner objected to the claims and description for various clarity issues.

1. Claims 2 and 13 misspelled "existence" as "existents". Claims 2 and 13 have been cancelled, rendering this objection moot.

2. Claims 5 and 16 recited the unclear term "etc.". Claims 5 and 16 have been cancelled, rendering this objection moot. The claimed feature that originally recited "etc." has been incorporated into amended independent claims 1 and 10, and the "etc." has been deleted. Withdrawal of the objection is respectfully requested.

3. Pages 16 and 17 of the description contained several paragraphs reciting that the invention is not limited by the disclosed embodiments. The Applicant has amended pages 16 and 17 to delete the objectionable language. Withdrawal of the objection is respectfully requested.

Arguments Re Item V

The Examiner rejected independent claims 1, 12, 22, and 26 (renumbered as claims 1, 10, 18, and 22, respectively) for lacking inventive step in view of Document D1 and D2. Regarding claim 1, for example, the Examiner argued that D1 discloses sending a log of measurement reports in several segments, and thus the difference between D1 and the subject matter of claim 1 is that claim 1 recites that the UE includes in its report message, an indicator of additional logged measurements not yet transmitted. He further argued that D2 discloses a field in a channel quality report indicating a mobility grade from which the base station should be able to deduce how many additional reports will follow.

The Applicant notes that neither D1 nor D2 expressly disclose the UE including in its report message, an indicator of additional logged measurements not yet transmitted. D2 is cited for this purpose, but only discloses an indicator of a mobility grade from which the base station should be able to *deduce* how many additional reports will follow.

Furthermore, the Examiner has concentrated on a technical problem of how to provide indicator signaling more efficiently, and the technical effect of the invention being to use less radio resources. While this is a technical effect of the invention, it is not the only effect. For example, claim 1 also recites that the network node decides whether the additional logged measurements are to be requested. The Examiner cited section 5.1.3 of D1 for disclosing, "the network can decide to retrieve the logged data base on this indication." However, the indication referred to in this passage is the earlier indication sent by the UE to prompt the network to initially request the logged measurements. This process is shown in FIG. 1 and is acknowledged to be prior art. There is no disclosure in D1 of the network deciding to retrieve additional logged measurements that were not sent in the initial report.

A review of D1-D4 has not revealed any disclosure or suggestion of the network node deciding whether to request additional logged measurements indicated in a report message to be available. This feature is recited in independent claims 1, 12, 22, and 26, and has the technical effect of providing the network node with the flexibility to request the additional measurements or not. For example, the network node may decide not to request the measurements if radio resources are not currently available. Or the network node may decide to request the measurements if the UE indicates its buffer state is full. This feature is not disclosed or suggested by D1-D4. Therefore, the allowance of claims 1, 12, 22, and 26 is respectfully requested.

The Applicant has further amended independent claims 1 and 10 to recite that the network node decides whether the additional logged measurements are to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resources; network node capacity; and UE buffer state condition.

The fact that the UE may report its buffer state is disclosed in the description on page 8, lines 4-8. The fact that the network node considers interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resources; network node capacity; and UE buffer state condition is disclosed in the description on page 8, lines 27-31.

A review of D1-D4 has not revealed any disclosure or suggestion of the network node considering any of these factors when deciding whether to request additional logged measurements indicated in a report message to be available. Therefore, the allowance of amended claims 1 and 10 is respectfully requested.

Allowance of dependent claims 2-9, 11-17, 19-21, and 23-26 is requested due to their recitation of additional features in combination with the features of the independent claims.

Re Item VII

1. The Examiner objected to the independent claims for not being in two-part format. The Applicant has recast the independent claims in two-part format.

2. The Examiner objected to the description for not describing the background art disclosed in documents D1-D3. The Applicant has amended the background section of the description to briefly summarize D1-D3.

3. The Examiner objected to an incorporation by reference on line 25 of page 17. The Applicant has deleted this material.

Conclusion

For all the above reasons, the Applicant respectfully requests a favorable examination report for amended claims 1-26.

Respectfully submitted,

Friedrich Kühn
European Patent Attorney

configuration needs to be provided from the OAM periodically to be conveyed to MDT capable UEs.

For the other proposal, sending too many RRC packets in a row could, in poor radio environments or when handover would occur, create problems with the radio connections and could also create unnecessary radio link failures that will make the users suffer and logged data be lost.

Further details of the 3GPP proposals may be found in Ericsson et al., "Further details on logged MDT measurement reporting", 3GPP Draft, R2-103086, 4 May 2010 (measurement reports may be sent in segments) and in Kyocera, "Inter-RAT MDT data retrieval and MDT (re)-configuration", 3GPP Draft, R2-104813, 17 August 2010 (UE sends indicator of available logged MDT data).

Additionally, international patent application number WO 2006/016690 discloses a field in a channel quality report indicating a mobility grade from which the base station should be able to deduce how many additional reports will follow.

SUMMARY

The technology disclosed herein concerns network based control of report messages comprising logged measurements in a wireless communications network, which overcomes at least some of the above mentioned disadvantages and which allows multiple partial report messages to be sent.

In accordance with some example embodiments, a UE that has stored logged data i.e. logged measurements that are bigger than a single transmission packet, i.e. report message, segments the data and sends only a portion of the data that fits into a single report message, and also indicates that more logged measurements exists at the UE.

In a first example of embodiment, there is disclosed a method in a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The method comprises sending a request to the UE to start transmitting logged measurements in a report message. The network node then receives the report message comprising the logged measurements from the UE, and determines if the received report

message comprises an indicator of additional logged measurements not yet transmitted, and if so, decides if the additional logged measurements need to be requested.

In a second example of an embodiment there is disclosed a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The network node comprises a network node communications interface and a network node processor circuit. The network node communications interface being configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements. The network node

facilitates that the network node 28 may determine an appropriate time of reporting without loosing logged measurements.

It will be appreciated by those skilled in the art that block diagrams of Fig. 2 herein may represent conceptual views of illustrative circuitry or other functional units embodying the principles of the technology. Similarly, it will be appreciated that any flow charts as of Fig. 3-Fig. 6, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

Functions of various elements including functional blocks of Fig. 2, including but not limited to those labeled or described as "computer", "processor" or "controller", may be provided through the use of hardware such as circuit hardware and/or hardware capable of executing software in the form of coded instructions stored on computer readable medium. Thus, such functions and illustrated functional blocks are to be understood as being either hardware-implemented and/or computer-implemented, and thus machine-implemented.

In terms of hardware implementation, the functional blocks of network node 28 or UE 30 may include or encompass, without limitation, Digital Signal Processor (DSP) hardware, reduced instruction set processor, hardware (e.g., digital or analog) circuitry including but not limited to Application Specific Integrated Circuit(s) [ASIC], and (where appropriate) state machines capable of performing such functions.

In terms of computer implementation, a computer is generally understood to comprise one or more processors or one or more controllers, and the terms computer and processor and controller may be employed interchangeably herein. When provided by a computer or processor or controller, the functions may be provided by a single dedicated computer or processor or controller, by a single shared computer or processor or controller, or by a plurality of individual computers or processors or controllers, some of which may be shared or distributed. Moreover, use of the term "processor" or "controller" shall also be construed to refer to other hardware capable of performing such functions and/or executing software, such as the example hardware recited above.

In the example of Fig. 5 the platform depicted by line 70 has been illustrated as computer-implemented or computer-based platform. Another example platform for wireless terminal

70(5) can be that of a hardware circuit, e.g., an application specific integrated circuit (ASIC) wherein circuit elements are structured and operated to perform the various acts described herein.

As will be recognized by those skilled in the art, the innovative concepts described in the present application can be modified and varied over a wide range of applications. Accordingly, the scope of patented subject matter should not be limited to any of the specific exemplary teachings discussed above, but is instead defined by the following claims.

CLAIMS

1. A method in a network node for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the UE (30), wherein the network node sends a request to the UE to start transmitting logged measurements in a report message, and receives the report message comprising logged measurements, the method being characterized by the steps of:
   - determining (S66) whether the received report message includes an indicator of additional logged measurements not yet transmitted; and
   - when the received report message includes an indicator of additional logged measurements not yet transmitted, deciding (S68) whether the additional logged measurements are to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resources; network node capacity; and UE buffer state condition.

2. The method according to claim 1, wherein the logged measurements comprise one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of the UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); and broadcast channel failure(s).

3. The method according to claim 1 or 2, wherein the report message is received directly from the UE or via another network node.

4. The method according to any preceding claim, wherein the determining (S66) step comprises determining whether the indicator indicates that there are logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

5. The method according to claim 4, wherein the deciding (S68) step comprises deciding (S79) to request all the logged measurements in the buffer of the UE in one subsequent request.

6. The method according to any preceding claim, wherein the method comprises receiving a previously sent report message from another network node automatically or upon request.

7. The method according to any preceding claim, wherein the sending of a request is initiated by a UE handover procedure from another network node to the network node.

8. The method according to claim 9, wherein the method comprises receiving a network node message from the other network node comprising UE specific information.

9. The method according to claim 10, wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

10. A network node (28) for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the user equipment (30), wherein the network node includes a communications interface (52) configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements, wherein the network node is characterized by:

- a network node processor circuit (50) configured to determine whether the received report message includes an indicator of additional logged measurements not yet transmitted, and if so, to decide whether the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resources; network node capacity; and UE buffer state condition.

11. The network node (28) according to claim 10, wherein the logged measurements comprise one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of the UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

12. The network node (28) according to claim 10 or 11, wherein the network node communications interface (52) is configured to request the report message directly from the UE or from another network node.

13. The network node (28) according to any of claims 10 to 12, wherein the network node processor circuit (50) is configured to the determine whether the indicator indicates that there are logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

14. The network node (28) according to claim 13, wherein the network node processor circuit (50) is configured to decide to request all the logged measurements in the buffer (44) of the UE in one subsequent request.

15. The network node (28) according to any of claims 10 to 14, wherein the network node communications interface (52) is configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node.

16. The network node (28) according to claim 15, wherein the network node communications interface (52) is configured to receive a network node message from the other network node comprising UE specific information.

17. The network node (28) according to claim 15, wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

18. A method in a User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a serving network node (28) and configured to transmit report messages to the network node (30) upon request, and wherein the UE (30) is configured to periodically perform radio condition measurements, store the periodically performed measurements in a UE buffer (44) as logged measurements, and receive a request from the network node (28) to start transmitting logged measurements in a report message, the method being characterized by the steps of:

- determining (S84) if the logged measurements fit in the report message; and if not,
- including (S86) in the report message an indicator of additional logged measurements not yet transmitted and an indicator of a UE buffer state condition;
- transmitting (S88) the report message, including the indicator, to the network node (28) as a response to the request; and
- sending to the network node, an indication of a UE buffer state condition for use by the network node in deciding whether the additional logged measurements need to be requested.

19. The method according to claim 18, wherein the including comprises including a reporting time stamp in the report message.

20. The method according to claim 18 or 19, wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

21. The method according to any of claims 18 to 20, wherein the logged measurements that are oldest in the buffer are reported first.

22. A User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a serving network node (28) and configured to transmit report messages to the network node (30), and wherein the UE (30) is configured to periodically perform radio condition measurements, store the periodically performed measurements in a buffer as logged measurements, receive a request from the network node (28) to start transmitting logged measurements in a report message, and transmit the report message comprising the logged measurements, wherein the UE (30) is characterized by:

- a UE processor circuit (40) configured to determine whether the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted that there are additional logged measurements not yet transmitted; and
- a UE communications interface (42) configured to send to the network node (28), an indication of a UE buffer state condition for use by the network node in deciding whether the additional logged measurements need to be requested.

23. The User Equipment (30) according to claim 22, wherein the UE processor circuit (40) is configured to add a reporting time stamp to the reporting message.

24. The User Equipment (30) according to claim 21 or 22 wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

25. The User Equipment (30) according to any of claims 22 to 24, wherein the logged measurements that are oldest in the buffer are transmitted first.

26. The User equipment (30) according to any of claims 22 to 25, wherein the logged measurements are Minimizing Drive Tests, MDT, log data.

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HWB 2380-1540

MINIMIZING DRIVE TEST LOGGED DATA REPORTING

TECHNICAL FIELD

[0001] This invention pertains to telecommunications, and particularly to the reporting of measurements by a wireless terminal to a radio access network (RAN).

BACKGROUND

[0002] In a typical cellular radio system, wireless terminals (also known as mobile stations and/or user equipment units (UEs)) communicate via a radio access network (RAN) to one or more core networks. The wireless terminals can be mobile stations or user equipment units (UE) such as mobile telephones ("cellular" telephones) and laptops with wireless capability (e.g., mobile termination), and thus can be, for example, portable, pocket, hand-held, computer-included, or car-mounted mobile devices which communicate voice and/or data via radio access network.

[0003] The radio access network (RAN) covers a geographical area which is divided into cell areas, with each cell area being served by a base station, e.g., a radio base station (RBS), which in some networks is also called "NodeB" or "B node". A cell is a geographical area where radio coverage is provided by the radio base station equipment at a base station site. Each cell is identified by an identity within the local radio area, which is broadcast in the cell. The base stations communicate over the air interface operating on radio frequencies with the user equipment units (UE) within range of the base stations.

[0004] In some versions (particularly earlier versions) of the radio access network, several base stations are typically connected (e.g., by landlines or microwave) to a radio network controller (RNC). The radio network controller, also sometimes termed a base station controller (BSC), supervises and coordinates various activities of the plural base stations connected thereto. The radio network controllers are typically connected to one or more core networks.

[0005] The Universal Mobile Telecommunications System (UMTS) is a third generation mobile communication system, which evolved from the Global System for Mobile Communications (GSM), and is intended to provide improved mobile communication services based on Wideband Code Division Multiple Access (WCDMA) access technology. UTRAN is essentially a radio access network using wideband code division multiple access for user equipment units (UEs). The Third Generation Partnership Project (3GPP) has undertaken to evolve further the UTRAN and GSM based radio access network technologies.

[0006] Long Term Evolution (LTE) is a variant of a 3GPP radio access technology wherein the radio base station nodes are connected directly to a core network rather than to radio network controller (RNC) nodes. In general, in LTE the functions of a radio network controller (RNC) node are performed by the radio base station nodes. As such, the radio access network (RAN) of an LTE system has an essentially "flat" architecture comprising radio base station nodes without reporting to radio network controller (RNC) nodes.

[0007] 3GPP is in the process of defining solutions for Minimizing Drive Tests (MDT). The intention of the Minimizing Drive Tests (MDT) work is documented in 3GPP TR 36.805 V9.0.0 (2009-12), 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on Minimization of drive-tests in Next Generation Networks (Release 9), incorporated herein by reference. Stage 2 of Minimizing Drive Tests (MDT) is currently being developed in TS 37.370, i.e., 3GPP TS 37.370, "Radio measurement collection for Minimization of Drive Tests (MDT);Overall description; Stage 2", also incorporated herein by reference. Minimizing Drive Tests (MDT) Stage 2 includes a UE measurement logging function and immediate reporting function. The 3GPP TS 37.370 document essentially focuses on the UE measurement logging function.

[0008] An important use case for Minimizing Drive Tests (MDT) is coverage optimization. For this purpose following UE measurements (or similar functionalities) are considered for UE-internal logging:

- Periodic (e.g. one every 5s) downlink pilot signal strength measurements.

- A Serving Cell becomes worse than threshold.
- Transmit power headroom becomes less than threshold.
- Paging Channel Failure (PCCH Decode Error).
- Broadcast Channel failure.

[0009] The network can request the UE to perform logging of measurements. The UE executes measurements and logs these measurements internally in a sequential manner, containing, e.g., some hour of logged measurement information.

[0010] As described in Fig. 1, UE indicates to the network if it has an available log, and the network requests the UE to deliver the log. From the eNB/RNC, the log is sent to an operations and management (OAM) server or similar.

[0011] The current 3GPP assumptions on this log feature are, e.g., as follows:

- The UE is required to maintain only one log at a time.
- One log only contains measurement information collected in one radio access technology (RAT).
- A log can only be reported and indicated when the UE is in connected state.
- If UE is requested to start logging (e.g., by configuration), a possibly old log and configuration stored in UE is erased.

[0012] The content of the MDT log according to configuration is reasonably settled and an estimation of the information can be made. *See*, e.g., R2-103511, "Log reporting considerations", Nokia Corporation, Nokia Siemens Networks, incorporated herein by reference (and referenced herein as "R2-103511")

[0013] What the measurement report in signal number 4 in Fig. 1 should look like has not yet been decided. As discussed briefly below, some proposals for measurement report have been proffered.

[0014] As one example proposal for measurement report, it has been suggested that a log be sent in a single packet, and keeping that single packet within the size limits of a packet data convergence protocol (PDCP) protocol data unit (PDU) (so that a RRC message can be used without being segmented into several smaller packets before sent to the receiving node (i.e., the eNB or NB/RNC in LTE or UMTS, respectively). *See*, e.g., R2-103511, "Log reporting considerations", Nokia Corporation, Nokia Siemens Networks; and R2-104839, "Optimizations for log size reduction", LG Electronics Inc., both of which are incorporated herein by reference. One option of this proposal would be limiting the maximum size of a log in a UE to one RRC message that fits in one packet data convergence protocol (PDCP) payload packet.

[0015] As another example, it has also been proposed to send a log that is larger than a RRC message with several RRC messages (although some believe the maximum size of a log in a UE can be limited to one RRC packet).

[0016] There are disadvantages to the proposals mentioned above. For example, limiting the log size could prevent logging to complete for the whole configured run time (logging duration), which can be several hours. The log could fill the limited log buffer in the UE before any report has been possible to send to the network. Before the configured logging duration time has ended, the UE would stop the logging so only to allow the log size to be a single packet, e.g. a packet data convergence protocol (PDCP) protocol data unit (PDU). Thus, this proposal could stop the logging so only allow the log size to be a single RRC packet, which is not good.

[0017] In the current MDT configuration a start time for the logging is not configurable. This means that for a prolonged logging campaign a long period between logging instances may be needed in the MDT configuration, alternatively new MDT configuration needs to be provided from the OAM periodically to be conveyed to MDT capable UEs.

[0018] For the other proposal, sending too many RRC packets in a row could, in poor radio environments or when handover would occur, create problems with the radio connections and could also create unnecessary radio link failures that will make the users suffer and logged data be lost. *See*, e.g., R2-103511. There is no mechanism specified to let the network control the transmission of several packets.

SUMMARY

[0001] The technology disclosed herein concerns log size for Minimizing Drive Tests (MDT). In one of its aspects the technology disclosed provides support for a log size exceeding a maximum size of the PDCP packet. As another aspect, the technology disclosed herein introduces and provides an indication from a UE of additional MDT log data that remains in UE.

[0002] The technology disclosed herein thus also allows network (NW) control of transmissions of multiple partial log packets. In accordance with some example embodiments, a UE that has stored logged data that is bigger than a single transmission packet segments the data and send only a portion of the data that fits into a single packet, and also indicates that more logged data exists at the UE. This indication of further remaining logged MDT data allows the network to decide the timing of transmission of the logged MDT data and the timing of when more measurements should be requested.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of preferred embodiments as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the various views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

[0004] Fig. 1 is a diagrammatic view illustrating how measurements are reported for logged measurements.

[0005] Fig. 2 is a schematic view of portions of an example embodiment of a communications system including a UE suitable for preparation and transmission of multiple partial MDT log packets.

[0006] Fig. 3 is a schematic view of portions of an example, more detailed embodiment of a wireless terminal (UE) suitable for preparation and transmission of multiple partial MDT log packets.

[0007] Fig. 4 is a flowchart showing example, non-limiting representative acts or steps in an example embodiment and mode of a method of generating multiple partial MDT log packets.

[0008] Fig. 5 is a schematic view of portions of an example, platform-based embodiment of a wireless terminal (UE) suitable for preparation and transmission of multiple partial MDT log packets.

DETAILED DESCRIPTION

[0009] In the following description, for purposes of explanation and not limitation, specific details are set forth such as particular architectures, interfaces, techniques, etc. in order to provide a thorough understanding of the present invention. However, it will be apparent to those skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. That is, those skilled in the art will be able to devise various arrangements which, although not explicitly described or shown herein, embody the principles of the invention and are included within its spirit and scope. In some instances, detailed descriptions of well-known devices, circuits, and methods are omitted so as not to obscure the description of the present invention with unnecessary detail. All statements herein reciting principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

[0010] Thus, for example, it will be appreciated by those skilled in the art that block diagrams herein can represent conceptual views of illustrative circuitry or other functional units embodying the principles of the technology. Similarly, it will be appreciated that any flow charts, state transition diagrams, pseudocode, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

[0011] The functions of the various elements including functional blocks, including but not limited to those labeled or described as "computer", "processor" or "controller",

may be provided through the use of hardware such as circuit hardware and/or hardware capable of executing software in the form of coded instructions stored on computer readable medium. Thus, such functions and illustrated functional blocks are to be understood as being either hardware-implemented and/or computer-implemented, and thus machine-implemented.

[0012] In terms of hardware implementation, the functional blocks may include or encompass, without limitation, digital signal processor (DSP) hardware, reduced instruction set processor, hardware (e.g., digital or analog) circuitry including but not limited to application specific integrated circuit(s) [ASIC], and (where appropriate) state machines capable of performing such functions.

[0013] In terms of computer implementation, a computer is generally understood to comprise one or more processors or one or more controllers, and the terms computer and processor and controller may be employed interchangeably herein. When provided by a computer or processor or controller, the functions may be provided by a single dedicated computer or processor or controller, by a single shared computer or processor or controller, or by a plurality of individual computers or processors or controllers, some of which may be shared or distributed. Moreover, use of the term "processor" or "controller" shall also be construed to refer to other hardware capable of performing such functions and/or executing software, such as the example hardware recited above.

[0014] Fig. 2 illustrates portions of an example embodiment of a communications system, and particularly portions of a radio access network (RAN) 20 comprising at least one network node 28 and a wireless terminal or UE 30. Depending on the particular type of radio access network (RAN) utilized and delegation of nodal responsibilities, the network node 28 can be a base station node (e.g., an NodeB in UMTS or an eNodeB in Long Term Evolution (LTE)) or a radio network controller (RNC) node (in UMTS). Thus, the user equipment unit (UE) 30 communicates over radio interface 32 with the network node 28, either directly over radio interface 32 with the network node 28 in the case of the network node 28 being a base station type node, or over the radio interface 32 and through a base station in the case of the network node 28 being a radio network controller (RNC) node.

[0015] As mentioned above, the user equipment unit (UE) 30 can be a mobile station such as a mobile telephone ("cellular" telephone) or laptop with wireless capability (e.g., mobile termination), and thus can be, for example, a portable, pocket, hand-held, computer-included, or car-mounted mobile device which communicates voice and/or data via radio access network.

[0016] In accordance with one of its aspect, the technology disclosed concerns generation and/or transmission and/or use of multiple partial MDT log packets. As such, Fig. 2 shows an example embodiment of network node or service point 30 which comprises multiple partial MDT log reporter 40 and communications interface 42. Fig. 2 also illustrates network node 28 as comprising MDT log requestor/processor 50 and communications interface 52.

[0017] Fig. 3 shows in more detail an example implementation of user equipment unit (UE) 30(3) and its multiple partial MDT log reporter 40. For the non-limiting example implementation of Fig. 3 the multiple partial MDT log reporter 40 comprises log report generator 60 and data logging unit 62. The multiple partial MDT log reporter 40 works in conjunction with measurement unit 64, and stores records 66 of measurements in data logging unit 62. Fig. 3 further shows log report generator 60 as comprising packet identifier generator 68 and "more data" flag generator 69.

[0018] The technology disclosed herein includes support for a MDT log size which exceeds a maximum size of the packet data convergence protocol (PDCP) packet. The technology disclosed herein also introduces and provides an indication from the UE 30 of additional MDT log data that remains in the UE. In accordance with some example embodiments, a UE that has stored logged data that is bigger than a single transmission packet, segments the data, and sends only a portion of the data that fits into a single packet, and also indicates that more logged data exists at the UE 30. This indication of further remaining logged MDT data allows the network to decide the timing of transmission of the logged MDT data and the timing of when more measurements should be requested.

[0019] The UE will take a part of the logged data and put into the payload of the Report message (as in act 4 of Fig 1). The UE 30 will, if more logged data is still available, set a "more" bit informing the network or by other means indicate to the network that there

are more logged data available in the UE. The network will then, when it believes more data should be obtained (based on interference, radio conditions, capacity, node capacity, etc.), request more data (as in act 3 of Fig. 1). When a request is done then the process is repeated.

[0020] In an example embodiment and mode, the technology disclosed herein encompasses the following acts and capabilities:

- UE periodically logs radio measurements (and possibly detailed positioning information of the UE) in internal memory.

- The log in UE memory is built up of "records" that include a "time stamp" (indicating the time when the radio measurement was taken) and "radio measurements". The record may optionally also include detailed position information of the UEs geographical position. The "records" can have variable size.

- The size of the log stored in UE is bigger than is possible to fit into one single Report message (such as message 4 of Fig 1) from UE to network.

- When the network requests UE to start reporting logged measurements, the UE takes the number of "records" from its internal log (in the order of storage) that fits into the Report message, and "advances" an internal pointer such that next-stored "records" will be included in the Report message next time UE is requested to report logged measurements.

- A "Time stamp" value or other identifier is added to the Report message at Report message transmission. Instead of including a time stamp into the Report message, a sequence number, stepped by one with each Report message transmission.

- In case UE has more "records" stored in its buffer, not yet reported, an indicator of "more data exist" is included into the Report message.

- If UE has indicated that "more data exist", network may then request UE to report logged measurements (repeat message 3 in Fig.1), and UE includes "records" from its stored log, according to its internal pointer.

[0021] During the repeated sequence of messages 3 and 4 in Fig 1 to convey the complete log from UE to network, there may be a need to change cell and base station (handover). One way to handle this is that the UE indicate availability when it is connects to the next eNB, e.g., message 1 in Fig. 1. A second way (alternative) to handle this situation is that the information that the old eNB has received with respect to "data available" and/or any "more data exist" information is transferred to new target eNB (based on request or automatically transferred) including any related information like trace references, etc.

[0022] In some situations, "trace references" + "data available" indication may be forwarded between RAN nodes. In such cases, the UE may also include the trace references in the report when UE reports first message to a RAN node after handover.

[0023] Fig. 4 shows example, non-limiting representative acts or steps in an example embodiment and mode of a method of generating multiple partial MDT log packets.

[0024] A yet more detailed, machine-implementation embodiment of an example user equipment unit (UE) 30(5) is illustrated in Fig. 5. In Fig. 5 broken line 70 depicts a platform by which functionalities and units illustrated within line 70 can be realized in example embodiments. The terminology "platform" is a way of describing how the functional units of wireless terminal (UE) 30 can be implemented or realized by machine. One example platform is a computer implementation wherein one or more of the elements framed by line 70, including wireless terminal measurement unit 44 and log report generator 60, are realized by one or more processors which execute coded instructions stored in memory (e.g., non-transitory signals) in order to perform the various acts described herein. In such a computer implementation the wireless terminal 30(5) can comprise, in addition to a processor(s), a memory section 72 (which in turn can comprise random access memory 74; read only memory 76; application memory 78 (which stores, e.g., coded instructions which can be executed by the processor to perform acts described herein); and any other memory such as cache memory, for example).

[0025] Whether or not specifically illustrated, typically the wireless terminal 30 of each of the embodiments discussed herein can also comprise certain input/output units or functionalities, the representative input/output units for wireless terminal 30(5) being

illustrated in Fig. 5 as keypad 80; audio input device (e.g. microphone) 82; visual input device (e.g., camera) 84; visual output device (e.g., display 86); and audio output device (e.g., speaker) 88. Other types of input/output devices can also be connected to or comprise wireless terminal 30(5).

[0026] In the example of Fig. 5 the platform depicted by line 70 has been illustrated as computer-implemented or computer-based platform. Another example platform for wireless terminal 70(5) can be that of a hardware circuit, e.g., an application specific integrated circuit (ASIC) wherein circuit elements are structured and operated to perform the various acts described herein.

[0027] It should be appreciated that the MDT log requestor/processor 50 of the network node 28 can also be implemented in platform fashion, e.g., implemented by a computer/processor executing instructions of non-transient signals and/or by a circuit.

[0028] In some example embodiments, if the UE indicates that more than one packet is in its logged buffer, several bits may then be used. The network can then choose to request multiple messages if the network so wants.

[0029] In some example embodiments, if the logged buffer is almost full or if a size limitation is to be reached otherwise, the UE can indicate such conditions to the network so the network can prioritize the retrieval of logged data in order not to stop logging and/or loose data.

[0030] Thus, the technology disclosed herein, in one of its aspects, supports and/or facilitates a log size exceeding the maximum size of the PDCP packet. If the reporting loss/performance is considered an issue and needs to addressed (while a restriction of a UEs total log size (in memory) is not wanted), then the UE that has stored logged data that is bigger than a single payload PDU (e.g PDCP restriction) can segment the data and send only a part that fits into a single packet (e.g., the message size in the UE response message has a fixed size, while the MDT log itself has another limit, e.g. memory size restriction in UE etc). To handle this, an indication in the UE MDT log report on that more logged data exists is provided. This allows the network to decide the timing for when measurements should be requested and/or (re-)configured. Relying on the "report available bit" only would require that the UE again transients to RRC

connected which may delay the transfer of logged data further, possibly involving UE log memory being exhausted, new logged MDT configuration or HO to other RAT etc.

[0031] Thus, with a log report size restriction, the UE shall be able to partition the log into a maximum fixed size RRC message.

[0032] Considering that the probability of losing a MDT report is relatively low, even in case of a handover is likely, etc., it can be assumed that the impact on the total amount of logged MDT data available at the OAM is small. It can also be assumed similarly, that by restricting the log size for all UEs reporting the MDT log, the available information at the receiving end will be limited accordingly; while possibly introducing complexity to the MDT configuration and signalling from OAM.

[0033] Currently the RRC message for MDT also carries information for RACH optimization (SON) and other optionally configured information. One consequence of the presence of other information in the RRC message/PDU using a size restriction would be that it possibly depends on the RRC message construction and configuration, or that the maximum size is always set according to a worst case scenario.

[0034] In view of the reasons above, no special handling of the RRC message/log size might be needed as a result of MDT. Retaining the normal handling of RRC messages etc simplifies the considerations that need to taken in the network and user equipment unit (UE).

[0035] The technology disclosed herein affords several advantages. Among the advantages are the following:

- The technology allows for long logging run times that can create large logged data sizes while the network controls the reporting time.
- The technology facilitates that the network can determine an appropriate time of reporting without loosing logged data.

Abbreviations

IP = Internet Protocol
LI = Length indicator
MDT = Minimization of the Drive Tests
NW = Network
PCCH = Paging Channel
RRM = Radio Resource Management
TR = Technical Report
TS = Technical specification
UE = User Equipment

[0036] Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. It will be appreciated that the scope of the present invention fully encompasses other embodiments which may become obvious to those skilled in the art, and that the scope of the present invention is accordingly not to be limited. Reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described embodiments that are known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed hereby. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it to be encompassed hereby.

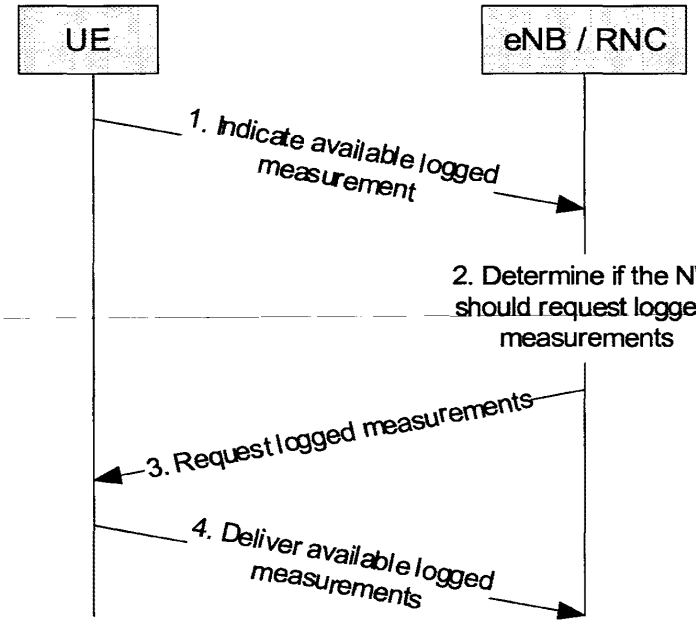

Fig. 1

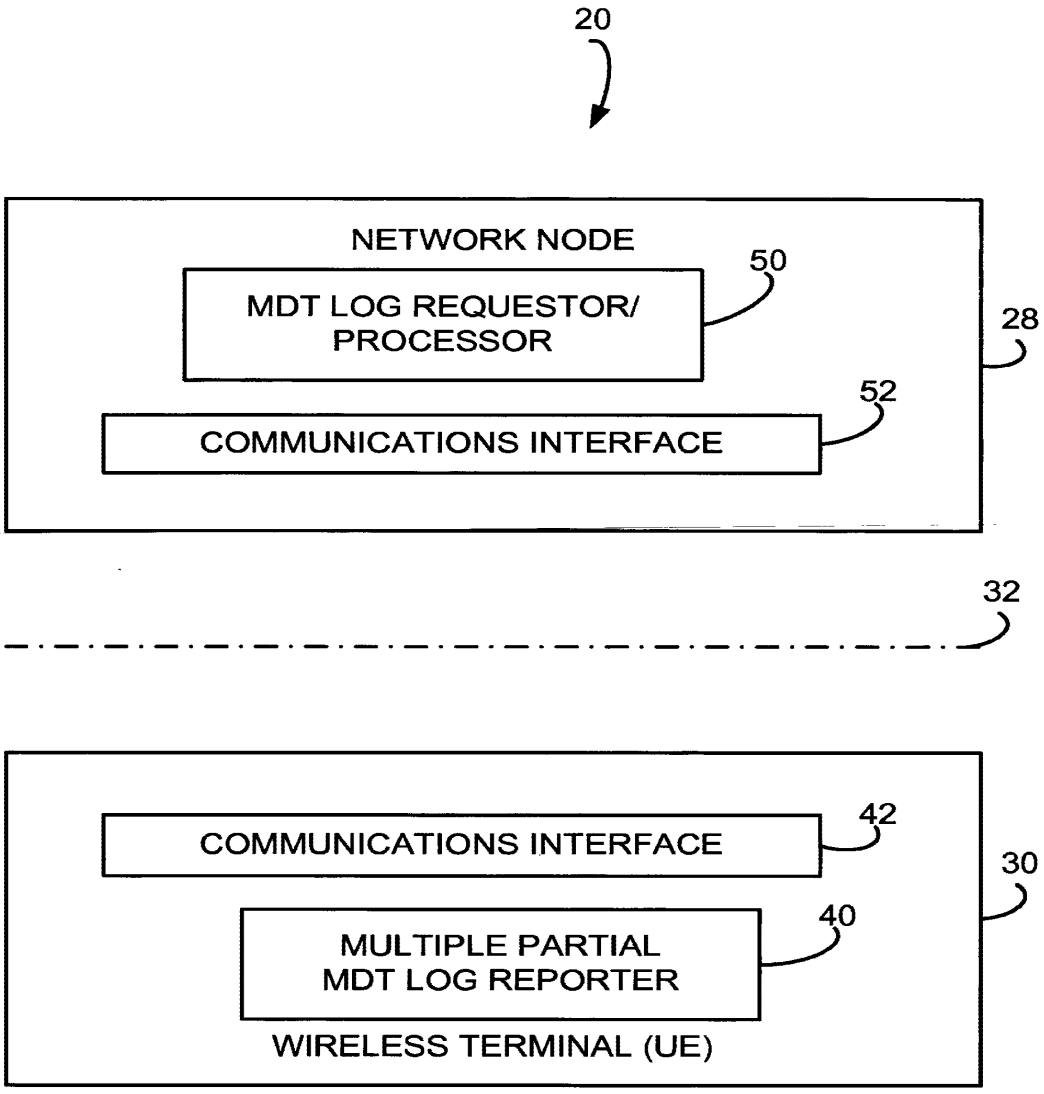

Fig. 2

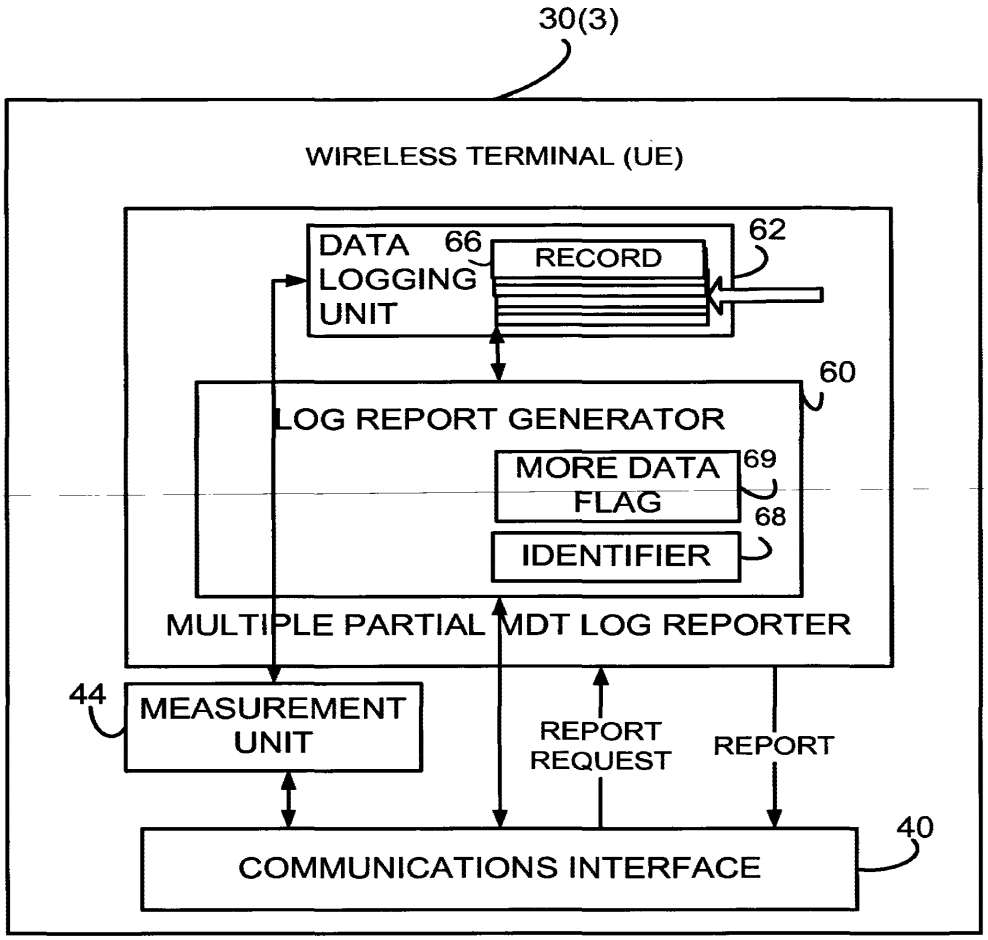

Fig. 3

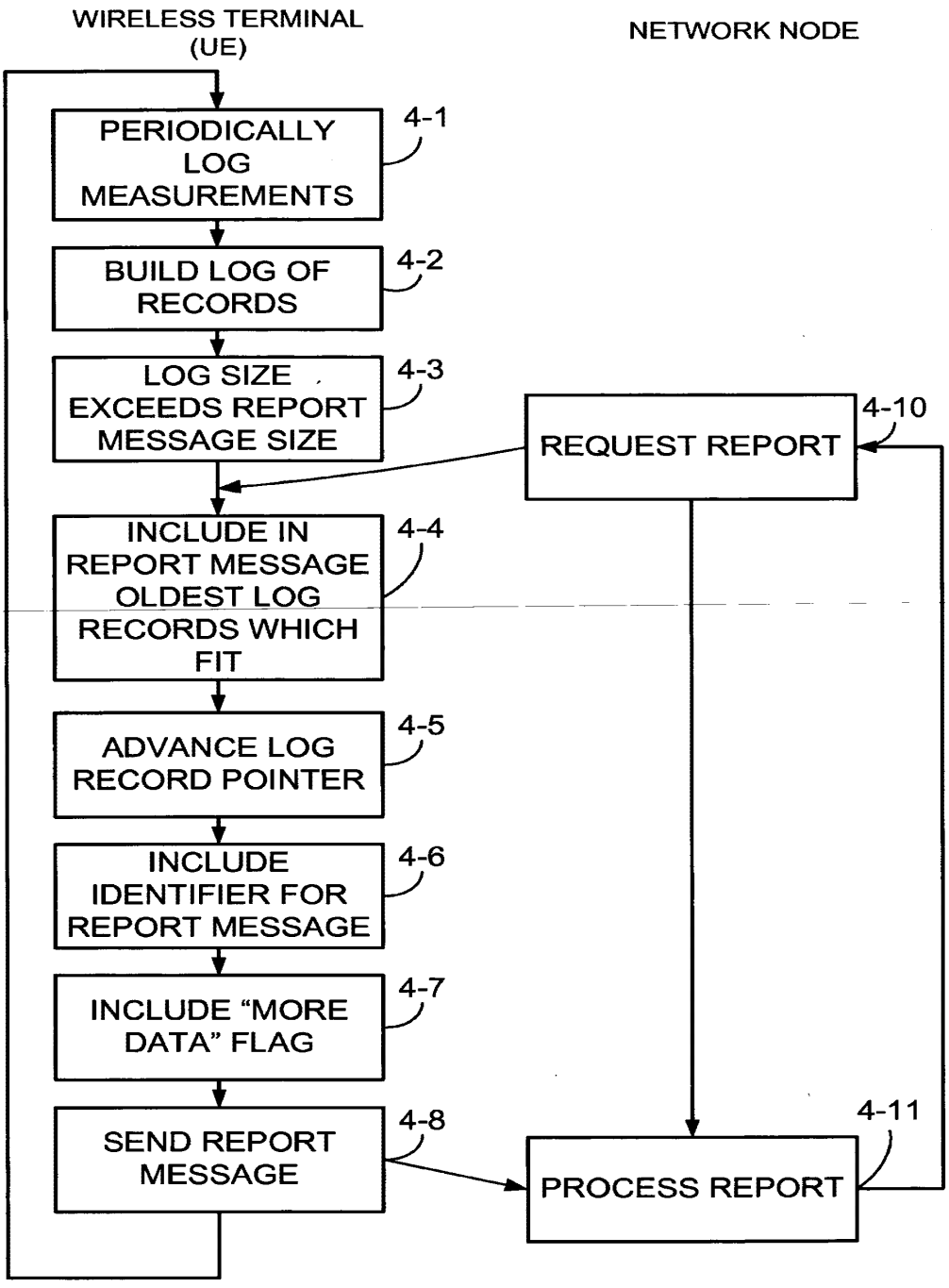

Fig. 4

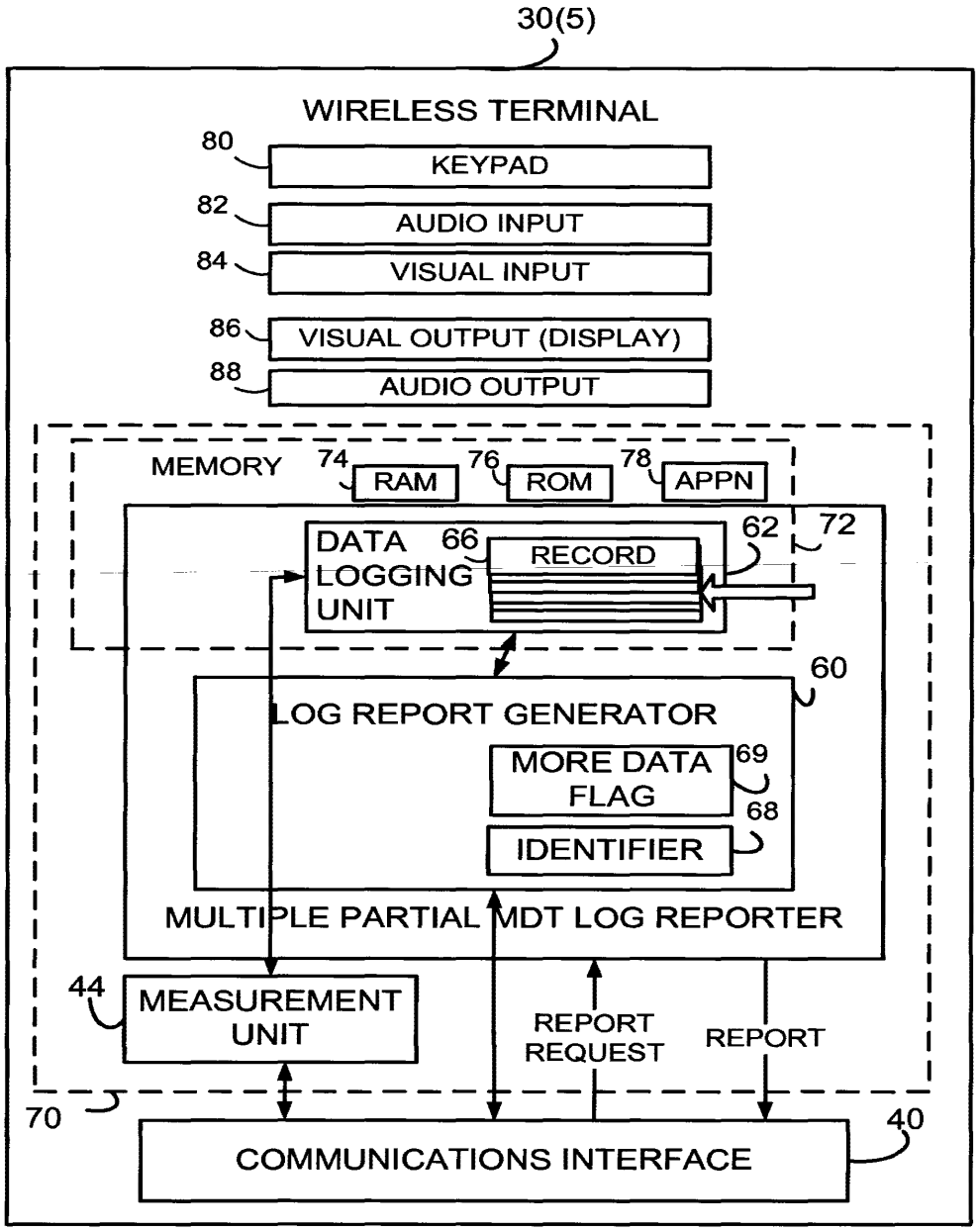

Fig. 5

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0-3	Name of receiving Office and "PCT International Application"	RO/SE

0-4	**Form PCT/RO/101 PCT Request**	
0-4-1	Prepared Using	PCT Online Filing Version 3.5.000.221 MT/FOP 20020701/0.20.5.9
0-5	**Petition** The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	**Receiving Office (specified by the applicant)**	Swedish Patent and Registration Office (RO/SE)
0-7	**Applicant's or agent's file reference**	P32817WO1
I	**Title of Invention**	NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK
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V-1	**The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.**	
VI-1	**Priority claim of earlier national application**	
VI-1-1	Filing date	04 October 2010 (04.10.2010)
VI-1-2	Number	61/389,581
VI-1-3	Country	US
VI-2	**Incorporation by reference :** where an element of the international application referred to in Article 11(1)(iii)(d) or (e) or a part of the description, claims or drawings referred to in Rule 20.5(a) is not otherwise contained in this international application but is completely contained in an earlier application whose priority is claimed on the date on which one or more elements referred to in Article 11(1)(iii) were first received by the receiving Office, that element or part is, subject to confir-mation under Rule 20.6, incorporated by reference in this international application for the purposes of Rule 20.6.	
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VIII-1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	
IX	**Check list**	Number of sheets	Electronic file(s) attached
IX-1	Request (including declaration sheets)	5	✓
IX-2	Description	17	✓
IX-3	Claims	5	✓
IX-4	Abstract	1	✓
IX-5	Drawings	6	✓
IX-7	TOTAL	34	
	Accompanying Items	Paper document(s) attached	Electronic file(s) attached
IX-8	Fee calculation sheet	-	✓
IX-18	PCT-SAFE physical media	-	-
IX-19	Other	Pre-conversion archive	✓
IX-20	**Figure of the drawings which should accompany the abstract**	3	
IX-21	**Language of filing of the international application**	English	
X-1	**Signature of applicant, agent or common representative**	/Joakim Hasselgren/	
X-1-1	Name (LAST, First)	HASSELGREN, Joakim	
X-1-2	Name of signatory	HASSELGREN, Joakim	
X-1-3	Capacity	(Representative)	

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10-2-2	Not received	
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[Continued on next page]

(54) **Title**: NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK

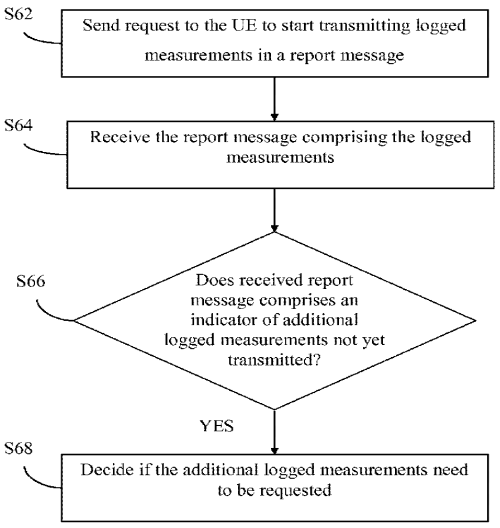

Fig. 3

(57) **Abstract**: This disclosure pertains to a method in a network node, a method in user equipment, a network node and user equipment in a wireless communications network. More particularly, there is provided methods and platforms for network based control of report messages comprising logged measurements in a wireless communications network. In accordance with some example embodiments, a UE (30) that has stored logged data i.e. logged measurements that are bigger than a single transmission packet,i.e. report message, segments the logged measurements and sends only a portion of the logged measurements that fits into a single report message. The UE (30)also indicates to a network node (28) that additional logged measurements exist at the UE buffer (44).

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NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK

TECHNICAL FIELD

This disclosure pertains to a method in a network node, a method in user equipment, a network node and user equipment in a wireless communications network. More particularly, there is provided mechanisms for network based control of report messages comprising logged measurements in a wireless communications network.

BACKGROUND

In a typical cellular radio system, wireless terminals, also known as mobile stations and/or User Equipments units (UEs), communicate via a Radio Access Network (RAN) to one or more core networks. The wireless terminals, hereinafter called UEs which is the same as User Equipments, can also be mobile telephones, i.e. "cellular" telephones, and laptops with wireless capability e.g., mobile termination, and thus are, for example, portable, pocket, hand-held, computer-included, or car-mounted mobile devices which communicate voice and/or data via the RAN.

The RAN normally covers a geographical area which is divided into cell areas, also denoted cells, with each cell area being served by a base station e.g., a Radio Base Station (RBS), which in some networks is also called "NodeB" or "B node". A cell is a geographical area where radio coverage is provided by base station equipment at a base station site. Each cell is identified by an identity within the local radio area, which is broadcast in the cell. The base station communicates over the air interface operating on radio frequencies with the UEs within range of the base stations.

In some versions, particularly earlier versions of the RAN, several base stations are typically connected, e.g., by landlines or microwave, to a Radio Network Controller (RNC). The RNC, also sometimes termed a Base Station Controller (BSC), supervises and coordinates various activities of the plural base stations connected thereto. The radio network controllers are typically connected to one or more core networks.

The Universal Mobile Telecommunications System (UMTS) is a third generation mobile communication system, which evolved from the Global System for Mobile Communications

(GSM), and is intended to provide improved mobile communication services based on Wideband Code Division Multiple Access (WCDMA) access technology. UTRAN is essentially a radio access network using wideband code division multiple access for user equipment units (UEs). The Third Generation Partnership Project (3GPP) has undertaken to evolve further the UTRAN and GSM based radio access network technologies.

Long Term Evolution (LTE) is a variant of a 3GPP radio access technology wherein the radio base station nodes are connected directly to a core network rather than to RNCs. In general, in LTE the functions of the RNC node are performed by the RBSs. As such, the RAN of an LTE system has an essentially "flat" architecture comprising RBSs without reporting to RNCs. In LTE networks the base station(s) is/are called eNodeB(s) or eNB(s).

3GPP is in the process of defining solutions for Minimizing Drive Tests (MDT). The intention of the Minimizing Drive Tests (MDT) work is documented in 3GPP TR 36.805 V9.0.0 (2009-12), 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on Minimization of drive-tests in Next Generation Networks (Release 9).

Stage 2 of Minimizing Drive Tests (MDT) is currently being developed in TS 37.320, i.e., 3GPP TS 37.320, "Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2". MDT Stage 2 includes a UE measurement logging function and immediate reporting function. The 3GPP TS 37.320 document essentially focuses on the UE measurement logging function.

An important use case for MDT is coverage optimization. For this purpose following UE measurements, or similar functionalities, are considered for UE-internal logging: Periodic, e.g. one every 5s, downlink pilot signal strength measurements; a serving cell becomes worse than threshold; transmit power headroom becomes less than threshold; Paging Channel Failure i.e. Paging Control CHannel (PCCH) decode error; and Broadcast Channel failure.

The network can request the UE to perform logging of measurements. The UE executes measurements and logs these measurements internally in a sequential manner, containing, e.g., some hour of logged measurement information.

As described in Fig. 1, the UE indicates to the network if it has available log i.e. available logged measurements. The network node i.e. eNB/RNC determines if it should request the logged measurements or not. If it decides to do so then a request is sent to the UE to deliver the

log in a report message. From the eNB/RNC, the reported logged measurements may further be sent to an OAM server or similar.

The current 3GPP assumptions on this log (i.e. logged measurements) feature are, e.g., as follows: the UE is required to maintain only one log at a time; one log only contains measurement information collected in one Radio Access Technology (RAT); a log can only be reported and indicated when the UE is in connected state; If UE is requested to start logging, e.g., by configuration, a possibly old log and configuration stored in UE is erased.

What the logged measurement report message in signal number 4 in Fig. 1 should look like has not yet been decided, as of the filing of this application. Some proposals for management of measurement report have been proffered.

As one example proposal for management of measurement reports, it has been suggested that a log i.e. logged measurements, are to be sent in a single packet, and keeping that single packet within the size limits of a Packet Data Convergence Protocol (PDCP) Protocol Data Unit (PDU). Keeping the single packet within the size limits of a PDCP PDU makes it possible to use a Radio Resource Control RRC message for reporting without being segmented into several smaller packets before being sent to the receiving node i.e., the eNB or NB/RNC in LTE or UMTS, respectively. One option of this proposal would be limiting the maximum size of a log in a UE to one RRC message that fits into one PDCP payload packet.

As another example proposal for management of measurement reports, it has been suggested to send a log i.e. a logged measurement that is larger than a RRC message with several RRC messages.

However, there are disadvantages to both example proposals mentioned above. For example, limiting the log size could prevent logging to complete for the whole configured run time i.e. logging duration, which can be several hours. The log could fill the limited log buffer in the UE before any measurement report has been possible to send to the network node. Before the configured logging duration time has ended, the UE would stop the logging so that to only allow the log size to be a single packet e.g. single RRC packet, and relevant measurements reports may not thereafter be logged. Also in the current MDT configuration a start time for the logging is not configurable. This means that for a prolonged logging campaign a long period between logging instances may be needed in the MDT configuration, alternatively new MDT

configuration needs to be provided from the OAM periodically to be conveyed to MDT capable UEs.

For the other proposal, sending too many RRC packets in a row could, in poor radio environments or when handover would occur, create problems with the radio connections and could also create unnecessary radio link failures that will make the users suffer and logged data be lost.

SUMMARY

The technology disclosed herein concerns network based control of report messages comprising logged measurements in a wireless communications network, which overcomes at least some of the above mentioned disadvantages and which allows multiple partial report messages to be sent.

In accordance with some example embodiments, a UE that has stored logged data i.e. logged measurements that are bigger than a single transmission packet, i.e. report message, segments the data and sends only a portion of the data that fits into a single report message, and also indicates that more logged measurements exists at the UE.

In a first example of embodiment, there is disclosed a method in a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The method comprises sending a request to the UE to start transmitting logged measurements in a report message. The network node then receives the report message comprising the logged measurements from the UE, and determines if the received report message comprises an indicator of additional logged measurements not yet transmitted, and if so, decides if the additional logged measurements need to be requested.

In a second example of an embodiment there is disclosed a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The network node comprises a network node communications interface and a network node processor circuit. The network node communications interface being configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements. The network node

processor circuit being configured to determine if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, to decide if the additional logged measurements need to be requested.

In a third example of an embodiment, there is disclosed a method in a User Equipment, UE, for assisting in network based control of report messages in a wireless communications network. The UE is being in connection with a serving network node and configured to transmit report messages to the network node upon request. The UE is further configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer as logged measurements. The method comprising: receiving a request, in the UE, from the network node to start transmitting logged measurements in a report message; determining if the logged measurements fit in the report message; and if not, including in the report message an indicator of additional logged measurements not yet transmitted; and, transmitting the report message, comprising the indicator, to the network node as a response to the request.

In a fourth example of an embodiment, there is disclosed a User Equipment, UE, for assisting in a network based control of report messages in a wireless communications network. The UE is being in connection with a serving network node and is configured to transmit report messages to the network node. The UE is further configured to periodically perform radio condition measurements and store the periodically performed measurements in a buffer as logged measurements. The UE comprises a UE communications interface and a UE processor circuit. The UE communications interface is configured to receive a request from the network node to start transmitting logged measurements in a report message, and to transmit the report message comprising the logged measurements. The UE processor circuit is configured to determine if the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

An advantage achieved by some of the above mentioned embodiments is that due to use of indicator in report message of further remaining logged measurements providing the network, i.e. a network node, with information needed to decide a timing of transmission of the logged measurements and a timing of when more logged measurements should be requested.

Another advantage achieved by at least some of the above mentioned embodiments is to make it possible to have longer logging duration and/or conduct more frequent measurements without overflow in log memory in UE e.g. UE buffer.

Another advantage achieved by some of the above mentioned embodiments is to provide the network node with information about logged measurements making it possible to determine the amount of logged measurements kept in a UE.

The foregoing and other objects, features, and advantages will become apparent from following more particular descriptions of preferred embodiments and aspects of embodiments as will be illustrated by accompanying drawings in which reference characters refer to the same parts throughout various views.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings are not necessarily to scale, emphasis instead being placed upon illustrating principles of the disclosure.

Fig. 1 is a signaling scheme illustrating how logged measurements are reported according to prior art.

Fig. 2 is a schematic block diagram illustrating example embodiments of a network node and a user equipment.

Fig. 3 is a flowchart depicting an example embodiment of a method in a network node.

Fig. 4 is a flowchart depicting further example embodiments of a method in a network node.

Fig. 5 is a flowchart depicting an example embodiment of a method in a user equipment.

Fig. 6 is a flowchart depicting further example embodiments of a method in a network node.

DETAILED DESCRIPTION

Fig. 2 illustrates portions of an example embodiment of a communications system/network, and particularly portions of a Radio Access Network (RAN) **20** comprising at least one network node **28** and a wireless terminal, hereinafter denoted User Equipment, (UE) **30**. Depending on a particular type of RAN utilized and delegation of nodal responsibilities, the

network node 28 may be a base station node e.g., an NodeB in UMTS or an eNodeB in Long Term Evolution (LTE)) or a Radio Network Controller (RNC) node in UMTS. Thus, the UE 30 communicates over radio interface **32** with the network node 28, either directly over radio interface 32 with the network node 28 in case of the network node 28 being a base station type node, or over the radio interface 32 and through a base station in the case of the network node 28 being a radio network controller (RNC) node or an Mobility Management Entity (MME) which is a control node which processes signaling between the UE and the Core Network (CN) and provides Visitor Location Register (VLR) functionality for the Evolved Packet System (EPS).

As mentioned above, the UE 30 can be a mobile station such as a mobile telephone ("cellular" telephone) or laptop with wireless capability (e.g., mobile termination), and thus can be, for example, a portable, pocket, hand-held, computer-included, or car-mounted mobile device which communicates voice and/or data via radio access network.

In accordance with one of its aspect, the technology disclosed concerns generation and/or transmission and/or use of multiple partial report messages with logged measurements such as MDT log packets, also denoted MDT log or MDT log data. As such, Fig. 2 shows an example embodiment of network node 28 or UE 30, which comprises a UE communication interface **42** and a UE processor circuit **40**. Note that the UE may be seen as a serving point. The UE processor circuit may include a buffer **44**, i.e. UE buffer, for storing logged measurements, not shown in figure, and in another embodiment the buffer 44 is within the UE 30.

Fig. 2 also illustrates network node 28 as comprising a network node processor circuit **50** and network node communications interface **52** (i.e. a communications interface of the network node). The network node processor circuit 50 may be, or comprise, a logged measurements requestor/processor (not shown in figure) to be used for requesting logged measurements, such as MDT log, in report message(s).

According to one example of an embodiment, the network node 28 is used for network based control of report messages comprising logged measurements in a wireless communications network, the network node 28 being configured to serve the UE 30, UE, and to receive report messages from the UE 30.

Continuing with the description of Fig. 2, the network node communications interface 52 is, or may be, configured to send request(s) to the UE 30 to start transmitting logged measurement(s) in report message(s), and to receive the report message(s) comprising the logged measurements. The logged measurements may comprise one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

According to one embodiment, the network node communications interface 52 may be configured to receive, from the UE 30, an indication of existents of logged measurements that are available. Note, that the "additional logged measurements" indicator is conveyed in the UE information report message while the indication of logged measurements available is conveyed in already existing/specified signaling.

According to one embodiment, the network node communications interface 52 may be configured to request the report message(s) directly from the UE 30 or from another network node, e.g. RNC, MME, RBS or other similar node.

According to one embodiment, the network node communications interface 52 may be configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node. The request may for example be a RRC connection request. The network node communications interface 52 may also be configured to receive a network node message from the other network node i.e. another eNodeB, RNC or RBS, comprising UE specific information. The UE specific information may further comprise the indicator indicating additional logged measurements not yet transmitted.

The network node processor circuit 50, mentioned above in relation to Fig.2, is configured to determine if the received report message(s) comprises an indicator of additional logged measurement(s) not yet transmitted; and if so, to decide if the additional logged measurements need to be requested. According to one embodiment, the network node processor circuit 50 may be configured to decide if the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc.

According to one embodiment, the network node processor circuit 50 may be configured to determine if the indicator indicates that there are logged measurements in a UE buffer 44 that do, or do not, fit in a single subsequent report message.

According to one embodiment, the network node processor circuit 50 may be configured to decide to request all the logged measurements in the buffer 44 of the UE in one subsequent request, or repeatedly upon receiving each report message. The decision may also be based on received status information of the buffer 44 in the UE 30 being for example overloaded. Note that configured to or adapted to in relation to functionality of circuits and devices mentioned above and throughout the whole disclosure are expressions that may be used having a similar or same meaning.

It should be appreciated that the network node processor circuit 50 may comprise an MDT log requestor/processor 50' (not shown in Fig. 2) which may be implemented in platform fashion, e.g., implemented by a computer/processor executing instructions of non-transient signals and/or by a circuit.

Likewise from a UE perspective, reference made to Fig. 2, the UE 30 may be, or is, used for assisting in network based control of report messages comprising logged measurements in a wireless communications network. The UE 30 is being in connection with the serving network node 28 and is configured to transmit report message(s) to the network node 30. The UE 30 may further be configured to periodically perform radio condition measurements and store the periodically performed measurements in the buffer 44 as logged measurements. Such logged measurements may be MDT log reports.

The UE communications interface 42 mentioned above in relation to Fig. 2, is configured to receive a request from the network node 28 to start transmitting logged measurements in report message(s), and to transmit/send the report message(s) comprising the logged measurements. The UE processor circuit 40 is configured to determine if the logged measurements fits in the report message(s), and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

According to one embodiment of an example implementation of a UE 30 in which the UE processor circuit 40 may be, or may comprise, a multiple partial MDT log reporter **40'** (Fig. 2 dashed lines). The multiple partial MDT log reporter 40' may comprise a log report generator

and data logging unit (not shown in Fig. 2). The multiple partial MDT log reporter 40' works in conjunction with a measurement unit (not shown in Fig. 2), and stores records of measurements in data logging unit. The log report generator may further comprise a packet identifier generator and "more data" i.e. additional data, flag generator.

The technology disclosed above, and in relation to some of the earlier mentioned embodiments, includes support for logged measurements, or an MDT log size, which exceeds a maximum size of the report message which may for example be a Packet Data Convergence Protocol (PDCP) packet. The technology disclosed herein also introduces and provides an indication from the UE 30 of additional logged measurements or MDT log data that remains in the UE buffer 44. In accordance with some example embodiments, a UE 30 that has stored logged measurements, sometimes denoted logged data, that are bigger than a single report message i.e. transmission packet, segments the logged measurements, and sends only a portion of the logged measurements that fits into a single report message. The UE 30 also indicates that more logged measurements exist at the UE 30 in the buffer 44. This indication of further remaining logged measurements allows the network node 28 to decide a timing of transmission of the logged measurements and a timing of when more logged measurements should be requested. This may for example depend on radio condition measurements or UE buffer status information.

The UE 30 will take a part of the logged measurements and put into the payload of the report message. The UE 30 will, if more logged measurements are still available, set a "more" or "additional" bit indicating to the network node 28, or by other means indicate to the network node 28, that there are more logged measurements available in the UE 30. The network node 28 will then, when it believes more data should be obtained e.g. based on: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc., request more logged measurements. When a request is done then the process may be repeated. A new decision may be taken after a new report message is received, and so on. In other words, upon reception of indication from UE, the network node 28 takes a decision (based on current radio conditions, node capacity) whether the network node 28 shall request more logged measurements "data" from the UE now or request it at a later point in time. This "later point in time" could be predefined e.g. 15s later. In one example an internal algorithm may for instance check to see if no Hand Over (HO) is imminent or other more vital procedure is at hand. The report messages

may be lost if unsuccessfully reporting happens just before a HO. In one example, the network node 28 may be configured to continue requesting reporting of logged measurements (MDT logs) in report messages until there are no more logged measurements to report.

An example of an embodiment of a method that may be implemented in the network node 28 is illustrated by **Fig. 3**. The method is used for network based control of report messages comprising logged measurements in a wireless communications network. According to the method, the network node 28 which is being configured to serve a UE 30, receives report messages from the UE 30 as mentioned above in relation to Fig. 2. More particularly, the method comprises: sending **S62** a request to the UE to start transmitting logged measurements in a report message; receiving **S64** the report message comprising the logged measurements; determining **S66** if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, deciding **S68** if the additional logged measurements need to be requested.

Yet an example of an embodiment of a method for implementation in the network node 28 is illustrated by **Fig. 4**. The general steps i.e. **S72, S74, S76** and **S78** correspond to S62-S68 mentioned above. In this example method comprises the network node 28 first receiving **S71**, e.g. from the UE 30, an indication of existents of logged measurements that are available i.e. the UE buffer 44 is not empty or more data exists in UE buffer 44. Note that this indication is different from the indicator indicating additional logged measurements.

According to the method, the network node 28 decides to send S72 request to the UE 30 to start reporting and receives S74 a report message as a response. The network node 28 then determines if the report message, which also comprises logged measurements and reporting time stamp, comprises an indicator of additional logged measurements not yet reported. If so, the network node 28 may decide S78 to request these additional logged measurements and therefore restarts at S72. If no indicator is included, the network node 28 will await **S77** a new indication S71, and restarts the procedure at S72. The network node 28 upon deciding S78 to request additional logged measurements may decide to request **S79** all logged measurements in one decision instead of requesting one subsequent report message at a time. In some example embodiments, if the UE 30 indicates that more than one reporting message is needed for the logged measurements in its UE buffer 44, several bits may then be used to indicate that. The

network node 28 may then choose to request multiple messages if the network node 28 so wants.

From a UE perspective, and an example of an embodiment which illustrates a method in a UE, reference is now made to **Fig. 5**. The UE 30 is configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer 44 as logged measurements. The method in the UE 30 for assisting in network based control of report messages comprising logged measurements in a wireless communications network, comprises: receiving **S82** a request from the network node 28 to start transmitting logged measurements in a report message; determining **S84** if the logged measurements fit in the report message; and if not, including **S86** in the report message an indicator of additional logged measurements not yet transmitted; and, transmitting **S88** the report message, comprising the indicator, to the network node 28 as a response to the request (S62; S72).

In an example of an embodiment and UE mode, the technology disclosed herein encompasses the following acts and capabilities, as illustrated by **Fig. 6**:

S90: UE periodically performs measurements and logs radio condition measurements, and possibly detailed positioning information of the UE 30, and stores the measurements as logged measurements in the UE buffer 44 i.e. in internal memory of the UE 30.

According to one embodiment the logged measurements in UE buffer 44 may be built up as "records" that include a "time stamp" indicating the time when the radio measurement was taken i.e. “measurement time stamp” and logged measurements. The record may optionally also include detailed position information of the UEs geographical position. The “records” may have variable size. The size of the logged measurements, sometimes denoted log size, in UE buffer 44 may be bigger than is possible to fit into one single report message to be sent from UE to network node.

S92: When the UE 30 receives a request from the network node 28 to start transmitting/reporting logged measurements, the UE 28 takes the number of "records" i.e. logged measurements, from the UE buffer 44 i.e. internal log, typically in the order of storage, that fits into the report message, and “advances” an internal pointer such that next-stored “records” will be included in the next report message next time the UE 30 is requested to report logged measurements.

This step, i.e. S92, may be preceded by that the UE 30 sending **S91** an indication to the network node 28 making it aware of logged measurements that are available at the UE 28.

S94: Upon receiving (S92) a request to start transmitting the UE 30 then determines if the logged measurements fit in a single report message or not.

If the logged measurements fit in one report message then no indicator is added or a dedicated bit for the indicator is left empty i.e. null is sent in that bit. Alternatively, an indication is added giving that no more information is available.

S96: In case the UE 30 has more logged measurements ("records") stored in the UE buffer 44 not yet reported an indicator of "additional logged measurements" i.e. more data exist is included in the report message.

A "Time stamp" value i.e. "Reporting time stamp" or other identifier is added to the report message at report message transmission. Alternatively, instead of including a reporting time stamp into the report message, a sequence number, stepped by one with each report message transmission may be used. Note that this reporting time stamp is different from the measurement time stamp added upon performing and logging the measurement.

S98: The UE 30 then transmits the report message, including oldest logged measurements obtained from UE buffer 44, to the network node 28 as a response to the request. The report message may therefore comprise logged measurements, a reporting time stamp and detailed positioning information of the UE 30.

S99: The UE 30 then deletes the transmitted/reported logged measurements from its buffer, i.e. UE buffer 44, and "advances" an internal pointer such that next-stored "records" will be included in the next report message. After receiving a new request from the network node 28 the UE 30 may then transmit/report logged measurements i.e. repeat steps S92-S99 and include new logged measurements i.e. "records", from the UE buffer 44, according to its internal pointer. Alternatively, or in combination with the reporting, the UE 30 may start again at step S90.

Note, that in current "MDT" general implementation the logging of measurements as logged measurements may only be done when UE is in "idle" state and the sending of logged

measurements (MDT logs) in report messages may only be done when the UE is in "connected" state.

In some example embodiments, if the UE buffer 44 is almost full or if a size limitation is to be reached, the UE 30 may indicate such conditions to the network node 28 during the sending S91 or adding that information during S96 and sending it during S98. The network node 28 may then prioritize the retrieval of logged measurements in order not to stop logging and/or loose logged measurements.

During the repeated sequence of messages between the UE 30 and the network node 28, to convey complete logged measurements from the UE 30 to the network node 28, there may be a need to change cell and/or serving Base Station (BS) e.g. during a handover form a first BS (eNB1; NB1; RNC1; RBS1) to a second BS (eNB1; NB1; RNC1; RBS1).

One way to handle cell change and/or BS change situations is that the UE indicate availability when it is connects to the second BS, e.g. according to S91 of Fig. 6. Thus the UE 30 being served by a first BS (e.g. eNB1) and which has for example sent two report messages to first BS, when performing a handover starts by sending an indication, i.e. sends S91 indication of logged measurements available, to second BS (e.g. eNB2) and then upon request starts reporting to second BS a third report message. Logged measurements that are sent in first and second report messages are generally deleted from UE buffer 44 and therefore not longer available.

A second way, or alternative, to handle this situation is that the information that the first BS (e.g. eNB1) has received with respect to "logged measurements available" as of step S91, is transferred to second BS (e.g. eNB2). The information is transferred based on a request from second BS or automatically, including any related information like trace references, etc. The idea here is to include the "indication" in already existing/specified handover preparation signaling (between eNB1 and eNB2) that is "preparing" the eNB2, before the UE is actually handed over (commanded) from eNB1 to eNB2.

In some situations, "trace references" and "logged measurements available" indication (S91) may be forwarded between RAN 20 nodes. In such cases, the UE 30 may also include the trace references in the report message when the UE 30 transmits a first report message to a RAN

node after handover. Note that this first report message, as of the example mentioned above in relation to the first way of handling the situation, would be the third report message.

Thus, the technology disclosed herein, in one of its aspects, supports and/or facilitates a log size exceeding a maximum size of a reporting message e.g. a PDCP packet. If the reporting loss/performance is considered an issue and needs to be addressed, while a restriction of a UEs total log size, in UE buffer or UE memory, is not wanted, then the UE that has stored logged measurements i.e. logged data, that is bigger than a single payload PDU (e.g due to PDCP restriction) may segment the logged measurements and send only a part that fits into a single report message/packet e.g., a message size in the UE response message has a fixed size while the MDT log itself has another limit e.g. UE buffer size restriction in UE 30 etc. To handle this, an indication in the report message e.g. the UE MDT log report, on that additional/more logged measurements exists is provided. This allows the network node 28 to decide the timing for when measurements should be requested and/or (re-)configured. Relying on the "report available bit" only would require that the UE again transients to RRC connected which may delay the transfer of logged measurements further, possibly involving UE log memory being exhausted, new logged MDT configuration or Hand Over (HO) to other Radio Access Technology (RAT) etc.

Thus, with a report message size restriction, the UE 30 shall be able to partition the logged measurements into a maximum fixed size reporting message e.g. an RRC message.

Currently the RRC message for MDT also carries information for RACH optimization (SON) and other optionally configured information. One consequence of the presence of other information in the RRC message/PDU using a size restriction would be that it possibly depends on the RRC message construction and configuration, or that the maximum size of a report message is always set according to a worst case scenario.

In view of the reasons above, no special handling of the RRC message/log size might be needed as a result of MDT. Retaining normal handling of RRC messages etc simplifies the considerations that need to taken in the network node 28 and UE 30.

The technology disclosed herein affords several advantages. Among the advantages are the following. The technology allows for long logging run times that may create large logged measurements sizes while the network node 28 controls the reporting time. The technology

facilitates that the network node 28 may determine an appropriate time of reporting without loosing logged measurements.

In the above description, for purposes of explanation and not limitation, specific details are set forth such as particular architectures, interfaces, techniques, etc. in order to provide a thorough understanding. However, it will be apparent to those skilled in the art that the above mentioned embodiments may be practiced in a ways that depart from these specific details. That is, those skilled in the art will be able to devise various arrangements which, although not explicitly described or shown herein, embody the principles of the embodiments and are included within their spirit and scope. In some instances, detailed descriptions of well-known devices, circuits, and methods are omitted so as not to obscure the description of the present embodiments with unnecessary detail. All statements herein reciting principles, aspects, and embodiments, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

Thus, for example, it will be appreciated by those skilled in the art that block diagrams of Fig. 2 herein may represent conceptual views of illustrative circuitry or other functional units embodying the principles of the technology. Similarly, it will be appreciated that any flow charts as of Fig. 3- Fig. 6, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

Functions of various elements including functional blocks of Fig. 2, including but not limited to those labeled or described as "computer", "processor" or "controller", may be provided through the use of hardware such as circuit hardware and/or hardware capable of executing software in the form of coded instructions stored on computer readable medium. Thus, such functions and illustrated functional blocks are to be understood as being either hardware-implemented and/or computer-implemented, and thus machine-implemented.

In terms of hardware implementation, the functional blocks of network node 28 or UE 30 may include or encompass, without limitation, Digital Signal Processor (DSP) hardware, reduced instruction set processor, hardware (e.g., digital or analog) circuitry including but not limited to

Application Specific Integrated Circuit(s) [ASIC], and (where appropriate) state machines capable of performing such functions.

In terms of computer implementation, a computer is generally understood to comprise one or more processors or one or more controllers, and the terms computer and processor and controller may be employed interchangeably herein. When provided by a computer or processor or controller, the functions may be provided by a single dedicated computer or processor or controller, by a single shared computer or processor or controller, or by a plurality of individual computers or processors or controllers, some of which may be shared or distributed. Moreover, use of the term "processor" or "controller" shall also be construed to refer to other hardware capable of performing such functions and/or executing software, such as the example hardware recited above.

In the example of Fig. 5 the platform depicted by line 70 has been illustrated as computer-implemented or computer-based platform. Another example platform for wireless terminal 70(5) can be that of a hardware circuit, e.g., an application specific integrated circuit (ASIC) wherein circuit elements are structured and operated to perform the various acts described herein.

Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. It will be appreciated that the scope of the present invention fully encompasses other embodiments which may become obvious to those skilled in the art, and that the scope of the present invention is accordingly not to be limited. Reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described embodiments that are known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed hereby. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it to be encompassed hereby.

CLAIMS

1. Method in a network node for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the UE (30), the method comprising:

   - sending (S62) a request to the UE to start transmitting logged measurements in a report message;

   - receiving (S64) the report message comprising logged measurements;

   - determining (S66) if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so,

   - deciding (S68) if the additional logged measurements are to be requested.

2. The method according to claim 1, wherein the method comprises receiving (S71), from the UE, an indication of existents of logged measurements that are available.

3. The method according to any of claims 1 or 2, wherein the logged measurements comprises one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); and broadcast channel failure(s).

4. The method according to any preceding claim, wherein the report message is received directly from the UE or via another network node.

5. The method according to any preceding claim, wherein the deciding (S68) is based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc.

6. The method according to any preceding claim, wherein the determining (S66) comprises determining if the indicator indicates that there is logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

7. The method according to claim 6, wherein the deciding (S68) comprises deciding (S79) to request all the logged measurements in the buffer of the UE in one subsequent request.

8. The method according to any preceding claim, wherein the method comprises receiving a previously sent report message from another network node(s), automatically or upon request.

9. The method according to any preceding claim, wherein the sending of a request is initiated by a UE handover procedure from another network node to the network node.

10. The method according to claim 9, wherein the method comprises receiving a network node message from the other network node comprising UE specific information.

11. The method according to claim 10, wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

12. A network node (28) for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the user equipment (30), the network node comprises:

- a network node communications interface (52) configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements;

- a network node processor circuit (50) configured to determine if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, to decide if the additional logged measurements need to be requested.

13. The network node (28) according to claim 12, wherein the network node communications interface (52) is configured to receive, from the UE, an indication of an existents of logged measurements that are available.

14. The network node (28) according to any of claims 12 or 13, wherein the logged measurements comprises one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit

power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

15. The network node (28) according to any of claims 12 to 14, wherein the network node communications interface (52) is configured to request the report message directly from the UE or from another network node.

16. The network node (28) according to any of claims 12 to 15, wherein the network node processor circuit (50) is configured to decide if the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc..

17. The network node (28) according to any of claims 12 to 16, wherein the network node processor circuit (50) is configured to the determine if the indicator indicates that there is logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

18. The network node (28) according to claim 17, wherein the network node processor circuit (50) is configured to decide to request all the logged measurements in the buffer (44) of the UE in one subsequent request.

19. The network node (28) according to any of claims 12 to 18, wherein the network node communications interface (52) is configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node.

20. The network node (28) according to claim 19, wherein the network node communications interface (52) is configured to receive a network node message from the other network node comprising UE specific information.

21. The network node (28) according to claim 19 wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

22. Method in a User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a

serving network node (28) and configured to transmit report messages to the network node (30) upon request, and wherein the UE (30) is configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer (44) as logged measurements, the method comprising:

- receiving (S82) a request from the network node (28) to start transmitting logged measurements in a report message;
- determining (S84) if the logged measurements fit in the report message; and if not,
- including (S86) in the report message an indicator of additional logged measurements not yet transmitted; and,
- transmitting (S88) the report message, comprising the indicator, to the network node (28) as a response to the request.

23. The method according to claim 22, wherein the including comprises including a reporting time stamp in the report message.

24. The method according to any of claims 22 or 23, wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

25. The method according to any of claims 22 to 24, wherein the logged measurements that are oldest in the buffer are reported first.

26. A User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a serving network node (28) and configured to transmit report messages to the network node (30), and wherein the UE (30) is configured to periodically perform radio condition measurements and store the periodically performed measurements in a buffer as logged measurements, the UE (30) comprises:

- a UE communications interface (42) configured to receive a request from the network node (28) to start transmitting logged measurements in a report message, and to transmit the report message comprising the logged measurements;

- a UE processor circuit (40) configured to determine if the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

27. The User Equipment (30) according to claim 26, wherein the UE processor circuit (40) is configured to add a reporting time stamp to the reporting message.

28. The User Equipment (30) according to any of claims 26 or 27 wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

29. The User Equipment (30) according to any of claims 26 to 28, wherein the logged measurements that are oldest in the buffer are transmitted first.

30. The User equipment (30) according to any of claims 26 to 29, wherein the logged measurements are Minimizing Drive Tests, MDT, log data.

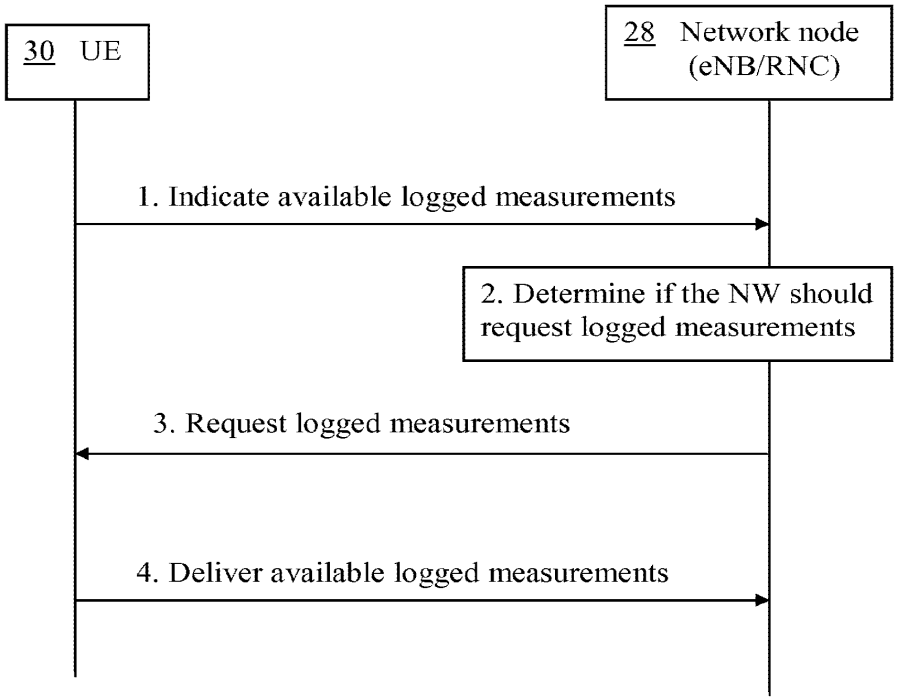

Fig. 1 (Prior art)

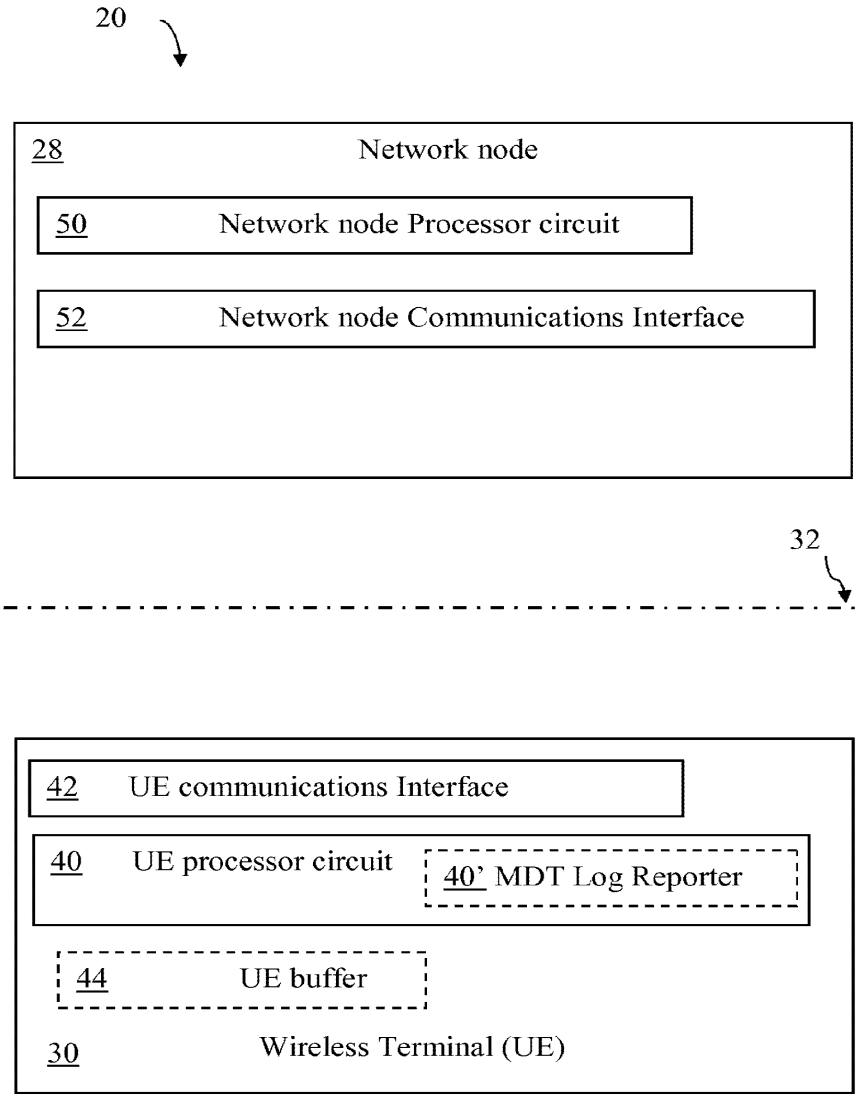
20
28
Network node
50
Network node Processor circuit
52
Network node Communications Interface
32
42
UE communications Interface
40
UE processor circuit
40' MDT Log Reporter
44
UE buffer
30
Wireless Terminal (UE)

Fig. 2

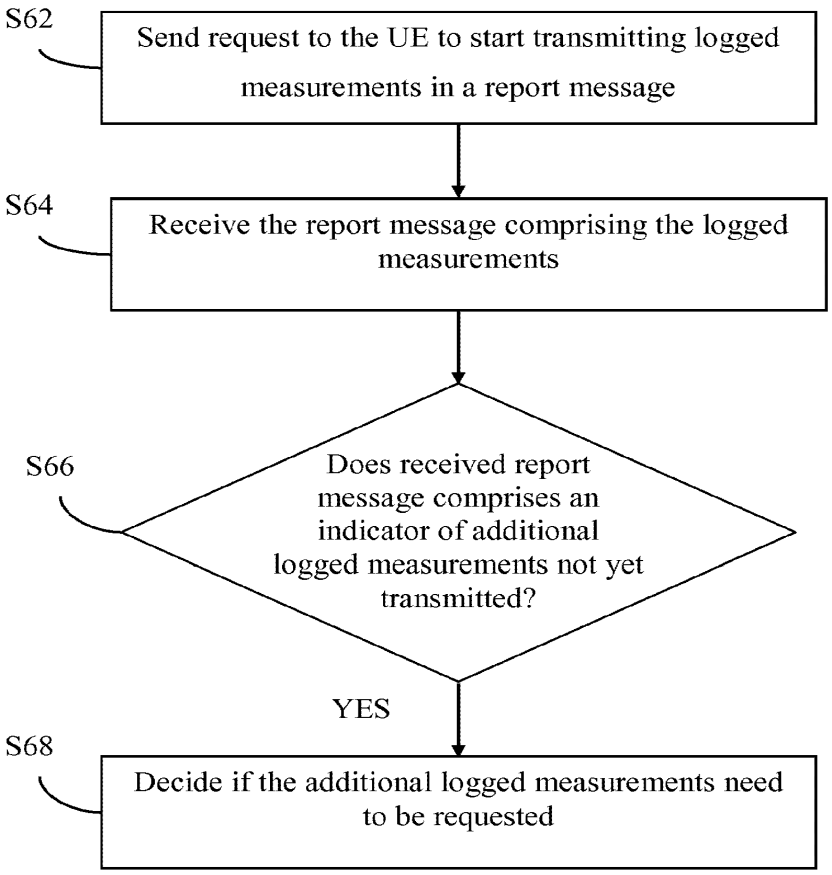
S62
Send request to the UE to start transmitting logged measurements in a report message
S64
Receive the report message comprising the logged measurements
S66
Does received report message comprises an indicator of additional logged measurements not yet transmitted?
YES
S68
Decide if the additional logged measurements need to be requested

Fig. 3

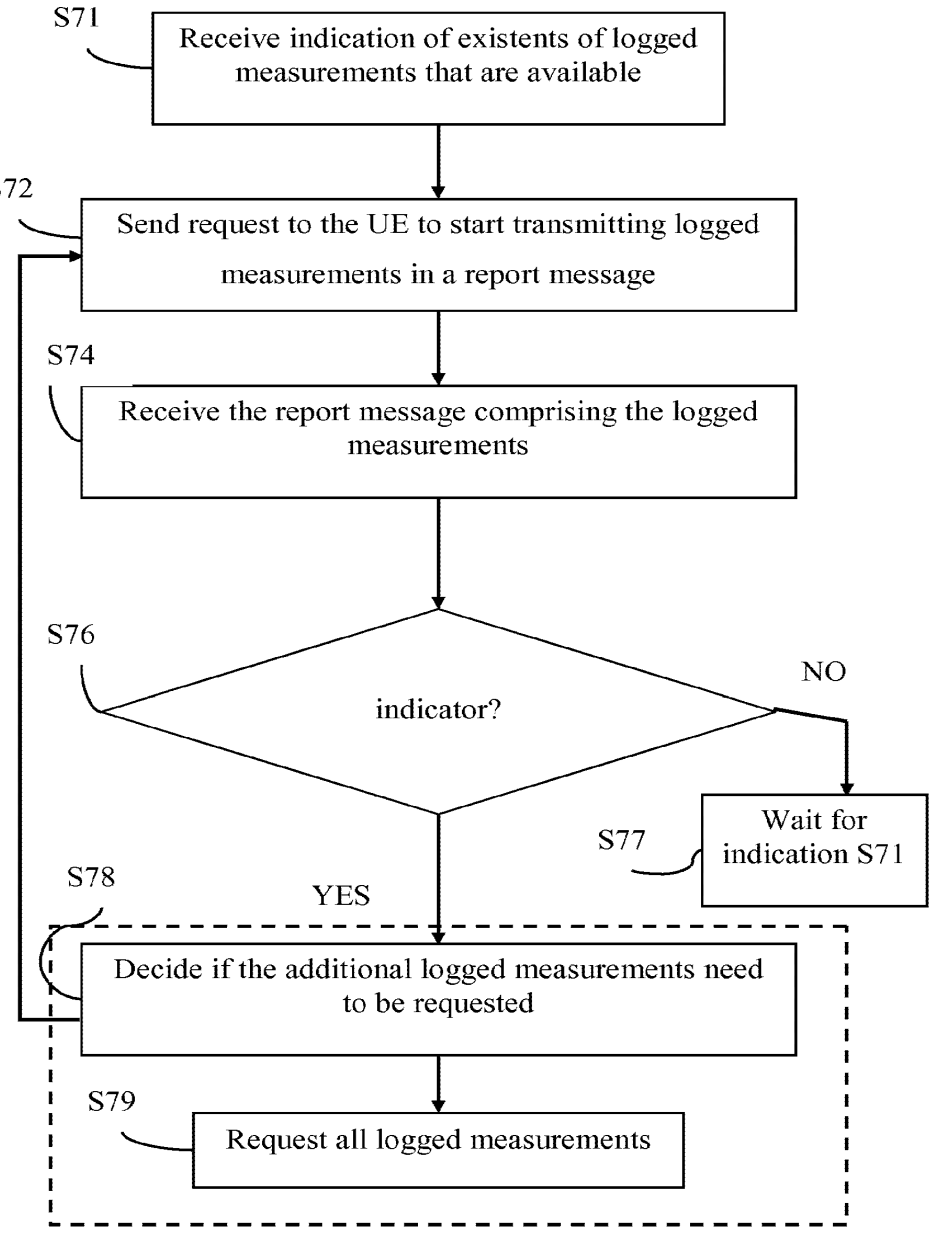
S71
Receive indication of existents of logged measurements that are available
S72
Send request to the UE to start transmitting logged measurements in a report message
S74
Receive the report message comprising the logged measurements
S76
indicator?
NO
S77
Wait for indication S71
S78
YES
Decide if the additional logged measurements need to be requested
S79
Request all logged measurements

Fig. 4

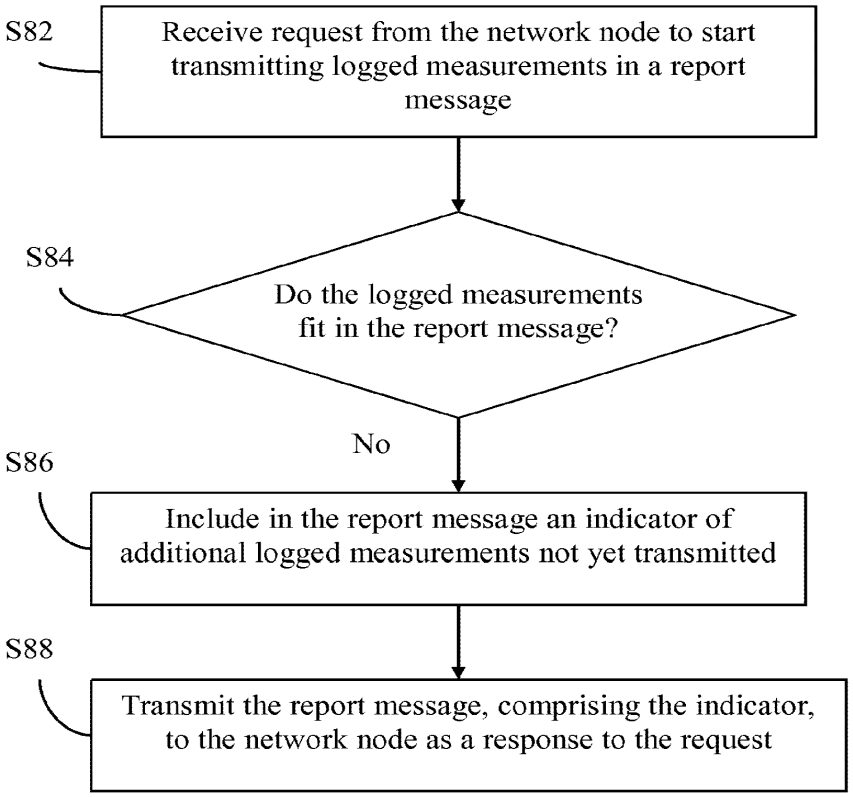
S82
Receive request from the network node to start transmitting logged measurements in a report message
S84
Do the logged measurements fit in the report message?
No
S86
Include in the report message an indicator of additional logged measurements not yet transmitted
S88
Transmit the report message, comprising the indicator, to the network node as a response to the request

Fig. 5

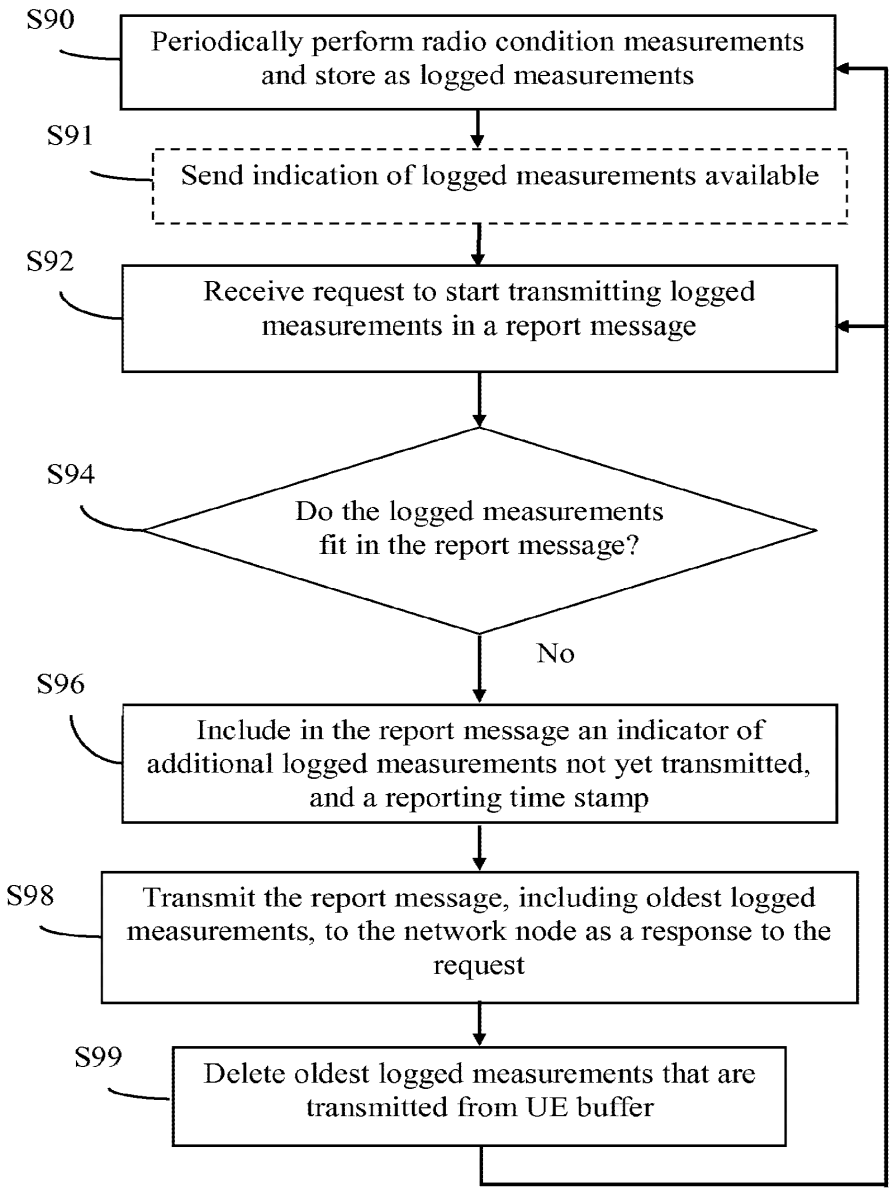
S90
Periodically perform radio condition measurements and store as logged measurements
S91
Send indication of logged measurements available
S92
Receive request to start transmitting logged measurements in a report message
S94
Do the logged measurements fit in the report message?
No
S96
Include in the report message an indicator of additional logged measurements not yet transmitted, and a reporting time stamp
S98
Transmit the report message, including oldest logged measurements, to the network node as a response to the request
S99
Delete oldest logged measurements that are transmitted from UE buffer

Fig. 6

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T. WALLACE
Certifying Officer

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Information:

2	Drawings-only black and white line drawings	2380-1540_drg_prov_Oct_4_10.pdf	51657 b7b2f7cec1afe59fec3bb51a3dff159077152687	no	5
Warnings:					
Information:					
3	Fee Worksheet (PTO-875)	fee-info.pdf	29786 01dd28941dad0966811b37a8f0a6441c9d0bcafb3	no	2
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HWB 2380-1540

MINIMIZING DRIVE TEST LOGGED DATA REPORTING

TECHNICAL FIELD

[0001] This invention pertains to telecommunications, and particularly to the reporting of measurements by a wireless terminal to a radio access network (RAN).

BACKGROUND

[0002] In a typical cellular radio system, wireless terminals (also known as mobile stations and/or user equipment units (UEs)) communicate via a radio access network (RAN) to one or more core networks. The wireless terminals can be mobile stations or user equipment units (UE) such as mobile telephones ("cellular" telephones) and laptops with wireless capability (e.g., mobile termination), and thus can be, for example, portable, pocket, hand-held, computer-included, or car-mounted mobile devices which communicate voice and/or data via radio access network.

[0003] The radio access network (RAN) covers a geographical area which is divided into cell areas, with each cell area being served by a base station, e.g., a radio base station (RBS), which in some networks is also called "NodeB" or "B node". A cell is a geographical area where radio coverage is provided by the radio base station equipment at a base station site. Each cell is identified by an identity within the local radio area, which is broadcast in the cell. The base stations communicate over the air interface operating on radio frequencies with the user equipment units (UE) within range of the base stations.

[0004] In some versions (particularly earlier versions) of the radio access network, several base stations are typically connected (e.g., by landlines or microwave) to a radio network controller (RNC). The radio network controller, also sometimes termed a base station controller (BSC), supervises and coordinates various activities of the plural base stations connected thereto. The radio network controllers are typically connected to one or more core networks.

[0005] The Universal Mobile Telecommunications System (UMTS) is a third generation mobile communication system, which evolved from the Global System for Mobile Communications (GSM), and is intended to provide improved mobile communication services based on Wideband Code Division Multiple Access (WCDMA) access technology. UTRAN is essentially a radio access network using wideband code division multiple access for user equipment units (UEs). The Third Generation Partnership Project (3GPP) has undertaken to evolve further the UTRAN and GSM based radio access network technologies.

[0006] Long Term Evolution (LTE) is a variant of a 3GPP radio access technology wherein the radio base station nodes are connected directly to a core network rather than to radio network controller (RNC) nodes. In general, in LTE the functions of a radio network controller (RNC) node are performed by the radio base station nodes. As such, the radio access network (RAN) of an LTE system has an essentially "flat" architecture comprising radio base station nodes without reporting to radio network controller (RNC) nodes.

[0007] 3GPP is in the process of defining solutions for Minimizing Drive Tests (MDT). The intention of the Minimizing Drive Tests (MDT) work is documented in 3GPP TR 36.805 V9.0.0 (2009-12), 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on Minimization of drive-tests in Next Generation Networks (Release 9), incorporated herein by reference. Stage 2 of Minimizing Drive Tests (MDT) is currently being developed in TS 37.370, i.e., 3GPP TS 37.370, "Radio measurement collection for Minimization of Drive Tests (MDT);Overall description; Stage 2", also incorporated herein by reference. Minimizing Drive Tests (MDT) Stage 2 includes a UE measurement logging function and immediate reporting function. The 3GPP TS 37.370 document essentially focuses on the UE measurement logging function.

[0008] An important use case for Minimizing Drive Tests (MDT) is coverage optimization. For this purpose following UE measurements (or similar functionalities) are considered for UE-internal logging:

- Periodic (e.g. one every 5s) downlink pilot signal strength measurements.

- A Serving Cell becomes worse than threshold.
- Transmit power headroom becomes less than threshold.
- Paging Channel Failure (PCCH Decode Error).
- Broadcast Channel failure.

[0009] The network can request the UE to perform logging of measurements. The UE executes measurements and logs these measurements internally in a sequential manner, containing, e.g., some hour of logged measurement information.

[0010] As described in Fig. 1, UE indicates to the network if it has an available log, and the network requests the UE to deliver the log. From the eNB/RNC, the log is sent to an operations and management (OAM) server or similar.

[0011] The current 3GPP assumptions on this log feature are, e.g., as follows:

- The UE is required to maintain only one log at a time.
- One log only contains measurement information collected in one radio access technology (RAT).
- A log can only be reported and indicated when the UE is in connected state.
- If UE is requested to start logging (e.g., by configuration), a possibly old log and configuration stored in UE is erased.

[0012] The content of the MDT log according to configuration is reasonably settled and an estimation of the information can be made. *See*, e.g., R2-103511, "Log reporting considerations", Nokia Corporation, Nokia Siemens Networks, incorporated herein by reference (and referenced herein as "R2-103511")

[0013] What the measurement report in signal number 4 in Fig. 1 should look like has not yet been decided. As discussed briefly below, some proposals for measurement report have been proffered.

[0014] As one example proposal for measurement report, it has been suggested that a log be sent in a single packet, and keeping that single packet within the size limits of a packet data convergence protocol (PDCP) protocol data unit (PDU) (so that a RRC message can be used without being segmented into several smaller packets before sent to the receiving node (i.e., the eNB or NB/RNC in LTE or UMTS, respectively). *See*, e.g., R2-103511, "Log reporting considerations", Nokia Corporation, Nokia Siemens Networks; and R2-104839, "Optimizations for log size reduction", LG Electronics Inc., both of which are incorporated herein by reference. One option of this proposal would be limiting the maximum size of a log in a UE to one RRC message that fits in one packet data convergence protocol (PDCP) payload packet.

[0015] As another example, it has also been proposed to send a log that is larger than a RRC message with several RRC messages (although some believe the maximum size of a log in a UE can be limited to one RRC packet).

[0016] There are disadvantages to the proposals mentioned above. For example, limiting the log size could prevent logging to complete for the whole configured run time (logging duration), which can be several hours. The log could fill the limited log buffer in the UE before any report has been possible to send to the network. Before the configured logging duration time has ended, the UE would stop the logging so only to allow the log size to be a single packet, e.g. a packet data convergence protocol (PDCP) protocol data unit (PDU). Thus, this proposal could stop the logging so only allow the log size to be a single RRC packet, which is not good.

[0017] In the current MDT configuration a start time for the logging is not configurable. This means that for a prolonged logging campaign a long period between logging instances may be needed in the MDT configuration, alternatively new MDT configuration needs to be provided from the OAM periodically to be conveyed to MDT capable UEs.

[0018] For the other proposal, sending too many RRC packets in a row could, in poor radio environments or when handover would occur, create problems with the radio connections and could also create unnecessary radio link failures that will make the users suffer and logged data be lost. *See*, e.g., R2-103511. There is no mechanism specified to let the network control the transmission of several packets.

SUMMARY

[0001] The technology disclosed herein concerns log size for Minimizing Drive Tests (MDT). In one of its aspects the technology disclosed provides support for a log size exceeding a maximum size of the PDCP packet. As another aspect, the technology disclosed herein introduces and provides an indication from a UE of additional MDT log data that remains in UE.

[0002] The technology disclosed herein thus also allows network (NW) control of transmissions of multiple partial log packets. In accordance with some example embodiments, a UE that has stored logged data that is bigger than a single transmission packet segments the data and send only a portion of the data that fits into a single packet, and also indicates that more logged data exists at the UE. This indication of further remaining logged MDT data allows the network to decide the timing of transmission of the logged MDT data and the timing of when more measurements should be requested.

BRIEF DESCRIPTION OF THE DRAWINGS

[0003] The foregoing and other objects, features, and advantages of the invention will be apparent from the following more particular description of preferred embodiments as illustrated in the accompanying drawings in which reference characters refer to the same parts throughout the various views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating the principles of the invention.

[0004] Fig. 1 is a diagrammatic view illustrating how measurements are reported for logged measurements.

[0005] Fig. 2 is a schematic view of portions of an example embodiment of a communications system including a UE suitable for preparation and transmission of multiple partial MDT log packets.

[0006] Fig. 3 is a schematic view of portions of an example, more detailed embodiment of a wireless terminal (UE) suitable for preparation and transmission of multiple partial MDT log packets.

[0007] Fig. 4 is a flowchart showing example, non-limiting representative acts or steps in an example embodiment and mode of a method of generating multiple partial MDT log packets.

[0008] Fig. 5 is a schematic view of portions of an example, platform-based embodiment of a wireless terminal (UE) suitable for preparation and transmission of multiple partial MDT log packets.

DETAILED DESCRIPTION

[0009] In the following description, for purposes of explanation and not limitation, specific details are set forth such as particular architectures, interfaces, techniques, etc. in order to provide a thorough understanding of the present invention. However, it will be apparent to those skilled in the art that the present invention may be practiced in other embodiments that depart from these specific details. That is, those skilled in the art will be able to devise various arrangements which, although not explicitly described or shown herein, embody the principles of the invention and are included within its spirit and scope. In some instances, detailed descriptions of well-known devices, circuits, and methods are omitted so as not to obscure the description of the present invention with unnecessary detail. All statements herein reciting principles, aspects, and embodiments of the invention, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

[0010] Thus, for example, it will be appreciated by those skilled in the art that block diagrams herein can represent conceptual views of illustrative circuitry or other functional units embodying the principles of the technology. Similarly, it will be appreciated that any flow charts, state transition diagrams, pseudocode, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

[0011] The functions of the various elements including functional blocks, including but not limited to those labeled or described as "computer", "processor" or "controller",

may be provided through the use of hardware such as circuit hardware and/or hardware capable of executing software in the form of coded instructions stored on computer readable medium. Thus, such functions and illustrated functional blocks are to be understood as being either hardware-implemented and/or computer-implemented, and thus machine-implemented.

[0012] In terms of hardware implementation, the functional blocks may include or encompass, without limitation, digital signal processor (DSP) hardware, reduced instruction set processor, hardware (e.g., digital or analog) circuitry including but not limited to application specific integrated circuit(s) [ASIC], and (where appropriate) state machines capable of performing such functions.

[0013] In terms of computer implementation, a computer is generally understood to comprise one or more processors or one or more controllers, and the terms computer and processor and controller may be employed interchangeably herein. When provided by a computer or processor or controller, the functions may be provided by a single dedicated computer or processor or controller, by a single shared computer or processor or controller, or by a plurality of individual computers or processors or controllers, some of which may be shared or distributed. Moreover, use of the term "processor" or "controller" shall also be construed to refer to other hardware capable of performing such functions and/or executing software, such as the example hardware recited above.

[0014] Fig. 2 illustrates portions of an example embodiment of a communications system, and particularly portions of a radio access network (RAN) 20 comprising at least one network node 28 and a wireless terminal or UE 30. Depending on the particular type of radio access network (RAN) utilized and delegation of nodal responsibilities, the network node 28 can be a base station node (e.g., an NodeB in UMTS or an eNodeB in Long Term Evolution (LTE)) or a radio network controller (RNC) node (in UMTS). Thus, the user equipment unit (UE) 30 communicates over radio interface 32 with the network node 28, either directly over radio interface 32 with the network node 28 in the case of the network node 28 being a base station type node, or over the radio interface 32 and through a base station in the case of the network node 28 being a radio network controller (RNC) node.

[0015] As mentioned above, the user equipment unit (UE) 30 can be a mobile station such as a mobile telephone ("cellular" telephone) or laptop with wireless capability (e.g., mobile termination), and thus can be, for example, a portable, pocket, hand-held, computer-included, or car-mounted mobile device which communicates voice and/or data via radio access network.

[0016] In accordance with one of its aspect, the technology disclosed concerns generation and/or transmission and/or use of multiple partial MDT log packets. As such, Fig. 2 shows an example embodiment of network node or service point 30 which comprises multiple partial MDT log reporter 40 and communications interface 42. Fig. 2 also illustrates network node 28 as comprising MDT log requestor/processor 50 and communications interface 52.

[0017] Fig. 3 shows in more detail an example implementation of user equipment unit (UE) 30(3) and its multiple partial MDT log reporter 40. For the non-limiting example implementation of Fig. 3 the multiple partial MDT log reporter 40 comprises log report generator 60 and data logging unit 62. The multiple partial MDT log reporter 40 works in conjunction with measurement unit 64, and stores records 66 of measurements in data logging unit 62. Fig. 3 further shows log report generator 60 as comprising packet identifier generator 68 and "more data" flag generator 69.

[0018] The technology disclosed herein includes support for a MDT log size which exceeds a maximum size of the packet data convergence protocol (PDCP) packet. The technology disclosed herein also introduces and provides an indication from the UE 30 of additional MDT log data that remains in the UE. In accordance with some example embodiments, a UE that has stored logged data that is bigger than a single transmission packet, segments the data, and sends only a portion of the data that fits into a single packet, and also indicates that more logged data exists at the UE 30. This indication of further remaining logged MDT data allows the network to decide the timing of transmission of the logged MDT data and the timing of when more measurements should be requested.

[0019] The UE will take a part of the logged data and put into the payload of the Report message (as in act 4 of Fig 1). The UE 30 will, if more logged data is still available, set a "more" bit informing the network or by other means indicate to the network that there

are more logged data available in the UE. The network will then, when it believes more data should be obtained (based on interference, radio conditions, capacity, node capacity, etc.), request more data (as in act 3 of Fig. 1). When a request is done then the process is repeated.

[0020] In an example embodiment and mode, the technology disclosed herein encompasses the following acts and capabilities:

- UE periodically logs radio measurements (and possibly detailed positioning information of the UE) in internal memory.

- The log in UE memory is built up of "records" that include a "time stamp" (indicating the time when the radio measurement was taken) and "radio measurements". The record may optionally also include detailed position information of the UEs geographical position. The "records" can have variable size.

- The size of the log stored in UE is bigger than is possible to fit into one single Report message (such as message 4 of Fig 1) from UE to network.

- When the network requests UE to start reporting logged measurements, the UE takes the number of "records" from its internal log (in the order of storage) that fits into the Report message, and "advances" an internal pointer such that next-stored "records" will be included in the Report message next time UE is requested to report logged measurements.

- A "Time stamp" value or other identifier is added to the Report message at Report message transmission. Instead of including a time stamp into the Report message, a sequence number, stepped by one with each Report message transmission.

- In case UE has more "records" stored in its buffer, not yet reported, an indicator of "more data exist" is included into the Report message.

- If UE has indicated that "more data exist", network may then request UE to report logged measurements (repeat message 3 in Fig.1), and UE includes "records" from its stored log, according to its internal pointer.

[0021] During the repeated sequence of messages 3 and 4 in Fig 1 to convey the complete log from UE to network, there may be a need to change cell and base station (handover). One way to handle this is that the UE indicate availability when it is connects to the next eNB, e.g., message 1 in Fig. 1. A second way (alternative) to handle this situation is that the information that the old eNB has received with respect to "data available" and/or any "more data exist" information is transferred to new target eNB (based on request or automatically transferred) including any related information like trace references, etc.

[0022] In some situations, "trace references" + "data available" indication may be forwarded between RAN nodes. In such cases, the UE may also include the trace references in the report when UE reports first message to a RAN node after handover.

[0023] Fig. 4 shows example, non-limiting representative acts or steps in an example embodiment and mode of a method of generating multiple partial MDT log packets.

[0024] A yet more detailed, machine-implementation embodiment of an example user equipment unit (UE) 30(5) is illustrated in Fig. 5. In Fig. 5 broken line 70 depicts a platform by which functionalities and units illustrated within line 70 can be realized in example embodiments. The terminology "platform" is a way of describing how the functional units of wireless terminal (UE) 30 can be implemented or realized by machine. One example platform is a computer implementation wherein one or more of the elements framed by line 70, including wireless terminal measurement unit 44 and log report generator 60, are realized by one or more processors which execute coded instructions stored in memory (e.g., non-transitory signals) in order to perform the various acts described herein. In such a computer implementation the wireless terminal 30(5) can comprise, in addition to a processor(s), a memory section 72 (which in turn can comprise random access memory 74; read only memory 76; application memory 78 (which stores, e.g., coded instructions which can be executed by the processor to perform acts described herein); and any other memory such as cache memory, for example).

[0025] Whether or not specifically illustrated, typically the wireless terminal 30 of each of the embodiments discussed herein can also comprise certain input/output units or functionalities, the representative input/output units for wireless terminal 30(5) being

illustrated in Fig. 5 as keypad 80; audio input device (e.g. microphone) 82; visual input device (e.g., camera) 84; visual output device (e.g., display 86); and audio output device (e.g., speaker) 88. Other types of input/output devices can also be connected to or comprise wireless terminal 30(5).

[0026] In the example of Fig. 5 the platform depicted by line 70 has been illustrated as computer-implemented or computer-based platform. Another example platform for wireless terminal 70(5) can be that of a hardware circuit, e.g., an application specific integrated circuit (ASIC) wherein circuit elements are structured and operated to perform the various acts described herein.

[0027] It should be appreciated that the MDT log requestor/processor 50 of the network node 28 can also be implemented in platform fashion, e.g., implemented by a computer/processor executing instructions of non-transient signals and/or by a circuit.

[0028] In some example embodiments, if the UE indicates that more than one packet is in its logged buffer, several bits may then be used. The network can then choose to request multiple messages if the network so wants.

[0029] In some example embodiments, if the logged buffer is almost full or if a size limitation is to be reached otherwise, the UE can indicate such conditions to the network so the network can prioritize the retrieval of logged data in order not to stop logging and/or loose data.

[0030] Thus, the technology disclosed herein, in one of its aspects, supports and/or facilitates a log size exceeding the maximum size of the PDCP packet. If the reporting loss/performance is considered an issue and needs to addressed (while a restriction of a UEs total log size (in memory) is not wanted), then the UE that has stored logged data that is bigger than a single payload PDU (e.g PDCP restriction) can segment the data and send only a part that fits into a single packet (e.g., the message size in the UE response message has a fixed size, while the MDT log itself has another limit, e.g. memory size restriction in UE etc). To handle this, an indication in the UE MDT log report on that more logged data exists is provided. This allows the network to decide the timing for when measurements should be requested and/or (re-)configured. Relying on the "report available bit" only would require that the UE again transients to RRC

connected which may delay the transfer of logged data further, possibly involving UE log memory being exhausted, new logged MDT configuration or HO to other RAT etc.

[0031] Thus, with a log report size restriction, the UE shall be able to partition the log into a maximum fixed size RRC message.

[0032] Considering that the probability of losing a MDT report is relatively low, even in case of a handover is likely, etc., it can be assumed that the impact on the total amount of logged MDT data available at the OAM is small. It can also be assumed similarly, that by restricting the log size for all UEs reporting the MDT log, the available information at the receiving end will be limited accordingly; while possibly introducing complexity to the MDT configuration and signalling from OAM.

[0033] Currently the RRC message for MDT also carries information for RACH optimization (SON) and other optionally configured information. One consequence of the presence of other information in the RRC message/PDU using a size restriction would be that it possibly depends on the RRC message construction and configuration, or that the maximum size is always set according to a worst case scenario.

[0034] In view of the reasons above, no special handling of the RRC message/log size might be needed as a result of MDT. Retaining the normal handling of RRC messages etc simplifies the considerations that need to taken in the network and user equipment unit (UE).

[0035] The technology disclosed herein affords several advantages. Among the advantages are the following:

- The technology allows for long logging run times that can create large logged data sizes while the network controls the reporting time.
- The technology facilitates that the network can determine an appropriate time of reporting without loosing logged data.

Abbreviations

IP = Internet Protocol
LI = Length indicator
MDT = Minimization of the Drive Tests
NW = Network
PCCH = Paging Channel
RRM = Radio Resource Management
TR = Technical Report
TS = Technical specification
UE = User Equipment

[0036] Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. It will be appreciated that the scope of the present invention fully encompasses other embodiments which may become obvious to those skilled in the art, and that the scope of the present invention is accordingly not to be limited. Reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described embodiments that are known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed hereby. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it to be encompassed hereby.

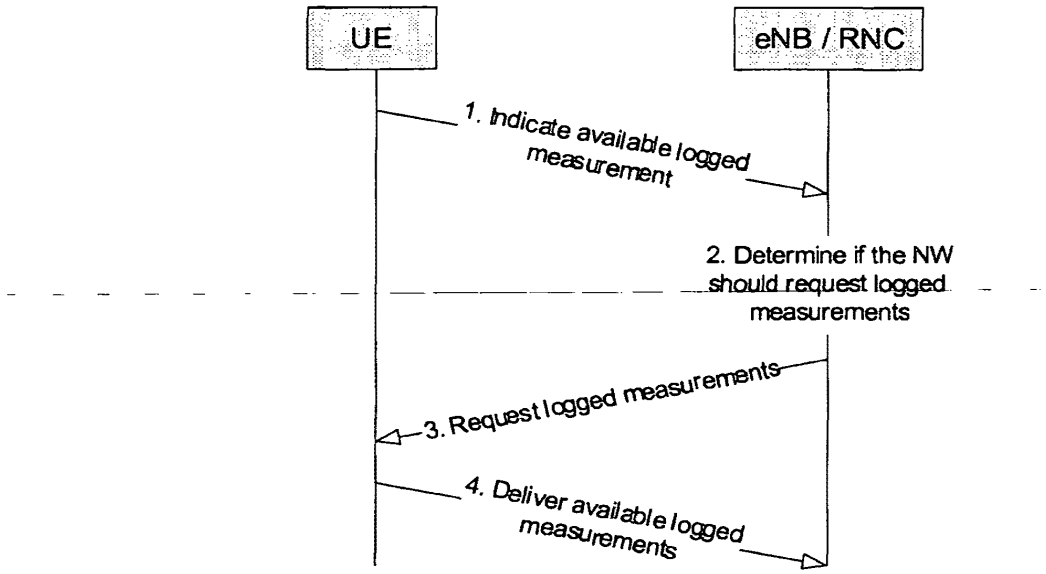

Fig. 1

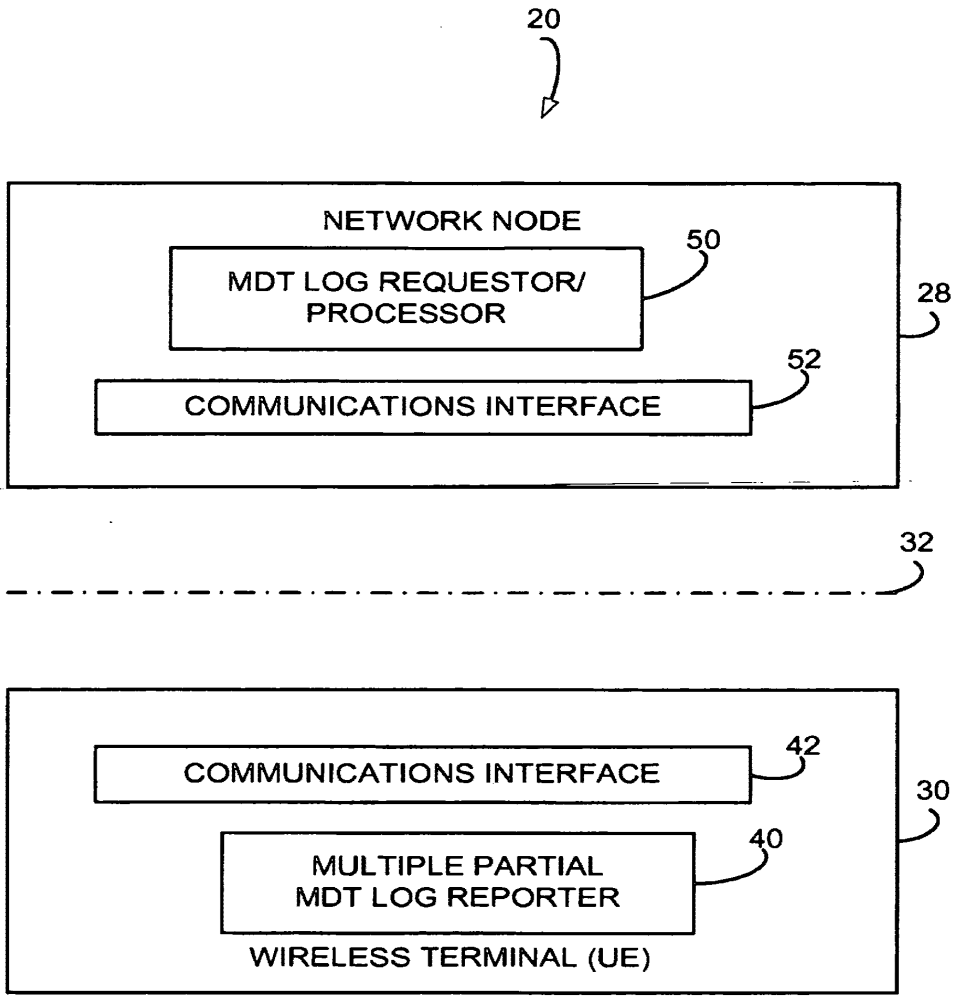

Fig. 2

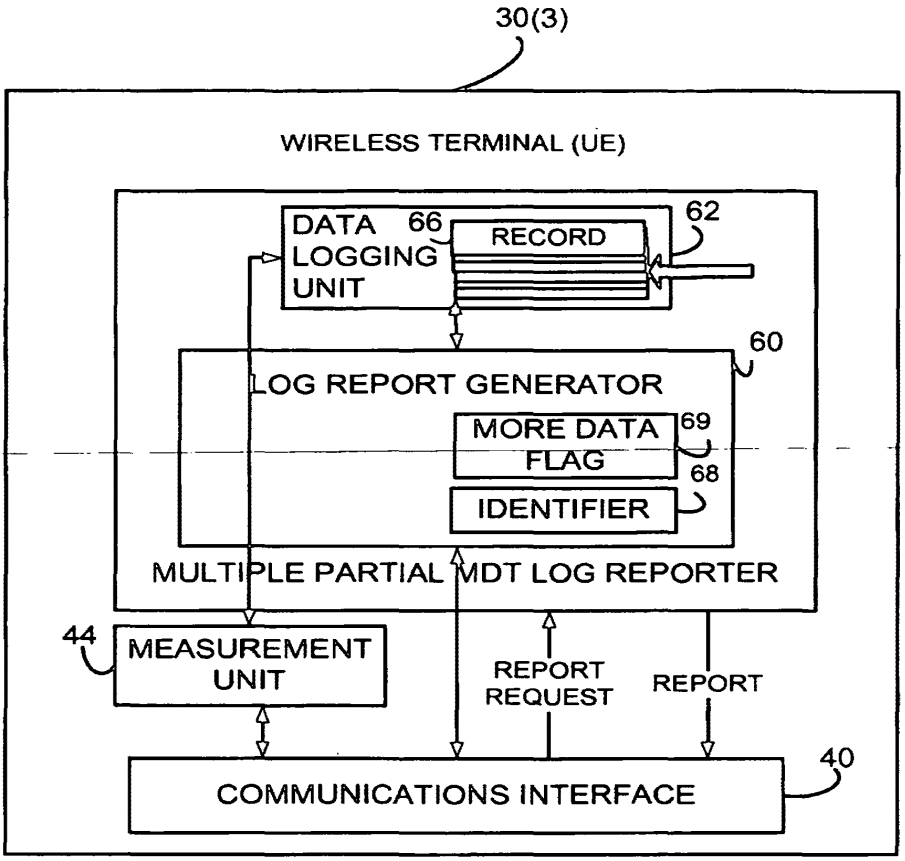

Fig. 3

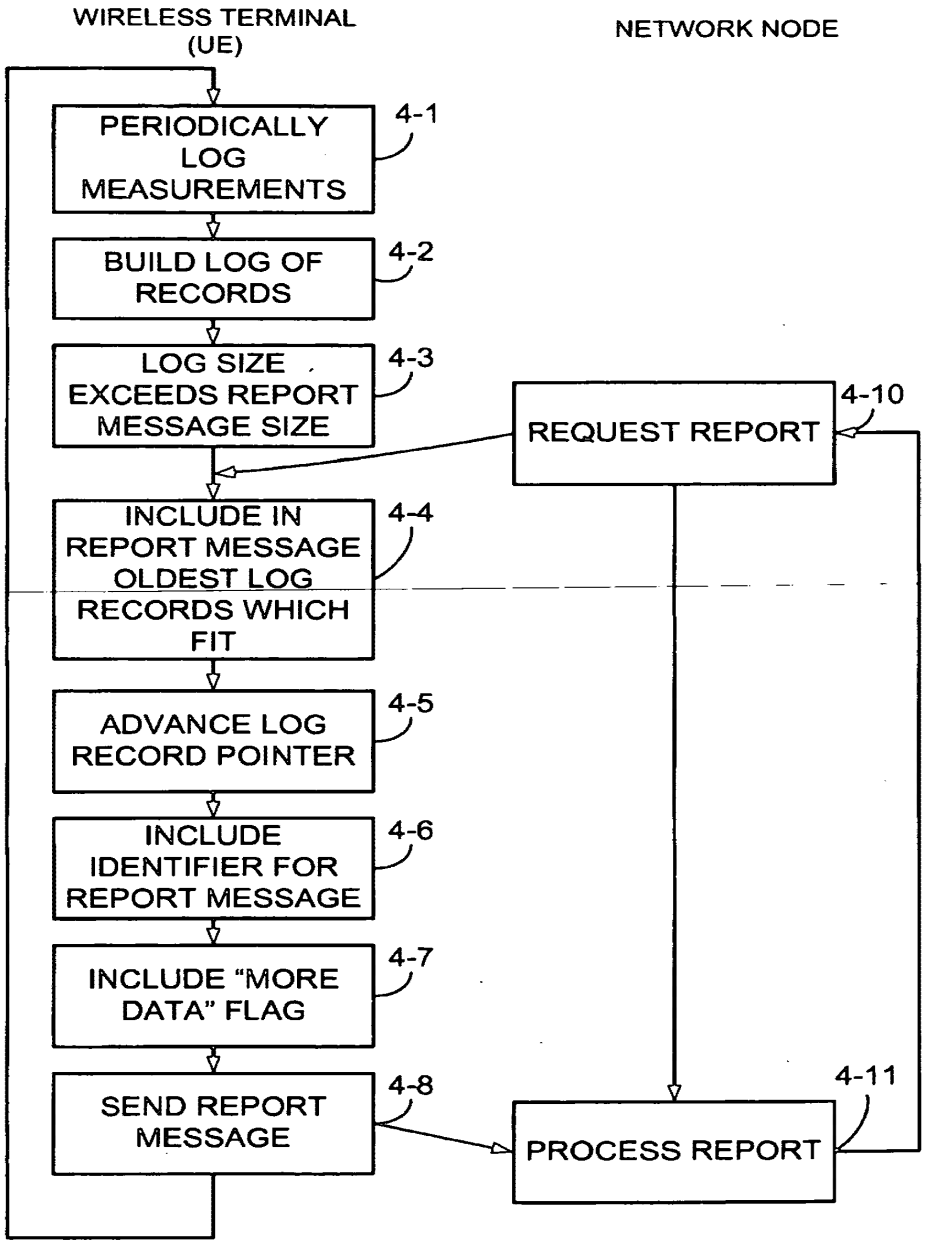

Fig. 4

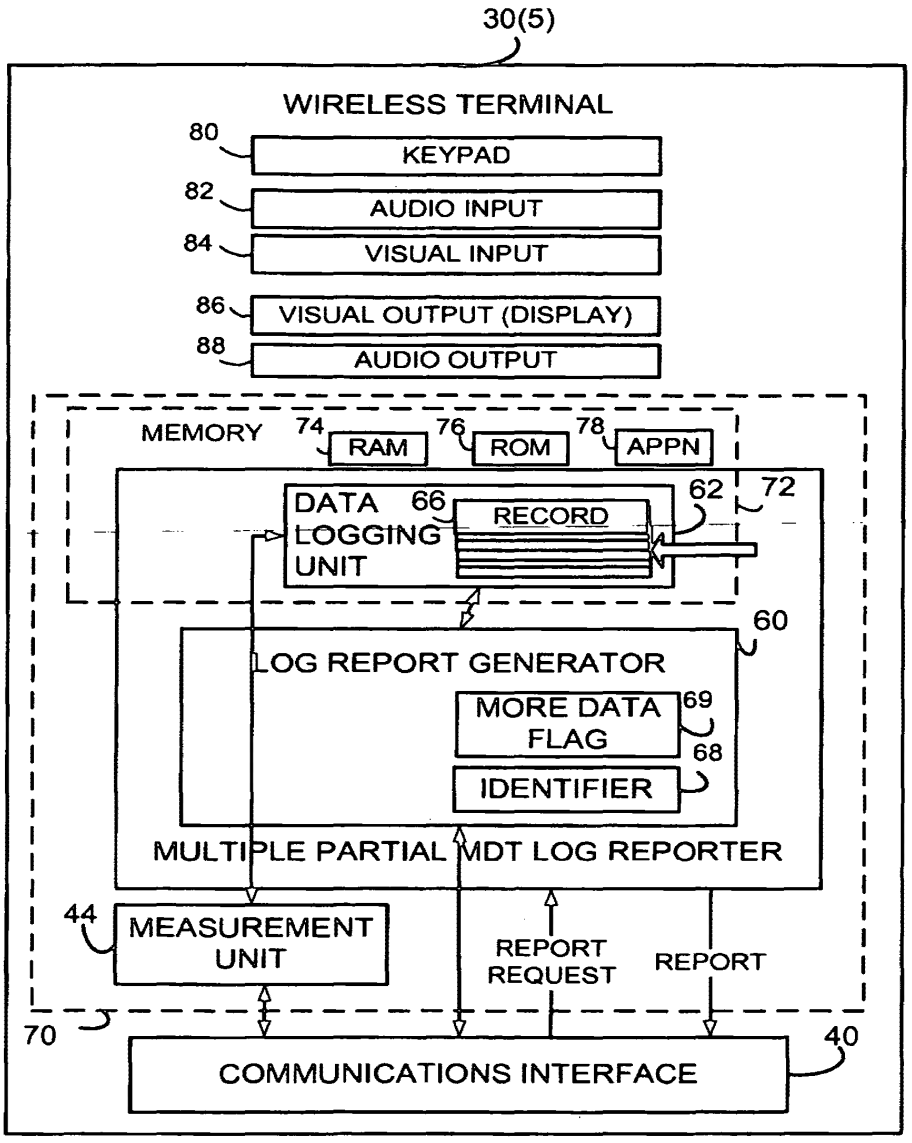

Fig. 5

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ERICSSON AB
Attn. Hasselgren, Joakim
Patent Unit LTE
Torshamnsgatan 23
SE-164 80 Stockholm
SUEDE

Date of mailing *(day/month/year)*: 11/01/2011

Applicant's or agent's file reference: P32817WO1

IMPORTANT NOTIFICATION

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SE2010/051355	09/12/2010	04/10/2010

Applicant: TELEFONAKTIEBOLAGET L M ERICSSON (PUBL)

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PCT/SE2010/051355	09-12-2010	04-10-2010

Applicant: TELEFONAKTIEBOLAGET L M ERICSSON (PUBL) et al

Title of the invention: NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK

1. The applicant is hereby notified that the international application has been accorded the international application number and the international filing date indicated above.

2. The applicant is further notified that the record copy of the international application:

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0	**For receiving Office use only**	
0-1	International Application No.	PCT/SE2010/051355
0-2	International Filing Date	09 December 2010 (09.12.2010)
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0-4	**Form PCT/RO/101 PCT Request**	
0-4-1	Prepared Using	PCT Online Filing Version 3.5.000.221 MT/FOP 20020701/0.20.5.9
0-5	**Petition** The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
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I	**Title of Invention**	NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK
II	**Applicant**	
II-1	This person is	Applicant only
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IV-1-5	e-mail	patent.development@ericsson.com
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VI-1	**Priority claim of earlier national application**	
VI-1-1	Filing date	04 October 2010 (04.10.2010)
VI-1-2	Number	61/389,581
VI-1-3	Country	US
VI-2	**Incorporation by reference :** where an element of the international application referred to in Article 11(1)(iii)(d) or (e) or a part of the description, claims or drawings referred to in Rule 20.5(a) is not otherwise contained in this international application but is completely contained in an earlier application whose priority is claimed on the date on which one or more elements referred to in Article 11(1)(iii) were first received by the receiving Office, that element or part is, subject to confirmation under Rule 20.6, incorporated by reference in this international application for the purposes of Rule 20.6.	
VII-1	**International Searching Authority Chosen**	European Patent Office (EPO) (ISA/EP)

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VIII	**Declarations**	Number of declarations	
VIII-1	Declaration as to the identity of the inventor	-	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	-	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	-	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	-	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	-	
IX	**Check list**	Number of sheets	Electronic file(s) attached
IX-1	Request (including declaration sheets)	5	✓
IX-2	Description	17	✓
IX-3	Claims	5	✓
IX-4	Abstract	1	✓
IX-5	Drawings	6	✓
IX-7	TOTAL	34	
	Accompanying Items	Paper document(s) attached	Electronic file(s) attached
IX-8	Fee calculation sheet	-	✓
IX-18	PCT-SAFE physical media	-	-
IX-19	Other	Pre-conversion archive	✓
IX-20	**Figure of the drawings which should accompany the abstract**	3	
IX-21	**Language of filing of the international application**	English	
X-1	**Signature of applicant, agent or common representative**	/Joakim Hasselgren/	
X-1-1	Name (LAST, First)	HASSELGREN, Joakim	
X-1-2	Name of signatory	HASSELGREN, Joakim	
X-1-3	Capacity	(Representative)	

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10-2	**Drawings:**	
10-2-1	Received	
10-2-2	Not received	
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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK

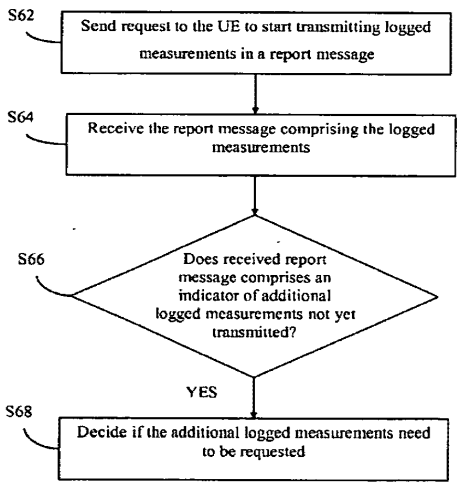

Fig. 3

(57) Abstract: This disclosure pertains to a method in a network node, a method in user equipment, a network node and user equipment in a wireless communications network. More particularly, there is provided methods and platforms for network based control of report messages comprising logged measurements in a wireless communications network. In accordance with some example embodiments, a UE (30) that has stored logged data i.e. logged measurements that are bigger than a single transmission packet,i.e. report message, segments the logged measurements and sends only a portion of the logged measurements that fits into a single report message. The UE (30)also indicates to a network node (28) that additional logged measurements exist at the UE buffer (44).

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— *with international search report (Art. 21(3))*

NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK

TECHNICAL FIELD

This disclosure pertains to a method in a network node, a method in user equipment, a network node and user equipment in a wireless communications network. More particularly, there is provided mechanisms for network based control of report messages comprising logged measurements in a wireless communications network.

BACKGROUND

In a typical cellular radio system, wireless terminals, also known as mobile stations and/or User Equipments units (UEs), communicate via a Radio Access Network (RAN) to one or more core networks. The wireless terminals, hereinafter called UEs which is the same as User Equipments, can also be mobile telephones, i.e. "cellular" telephones, and laptops with wireless capability e.g., mobile termination, and thus are, for example, portable, pocket, hand-held, computer-included, or car-mounted mobile devices which communicate voice and/or data via the RAN.

The RAN normally covers a geographical area which is divided into cell areas, also denoted cells, with each cell area being served by a base station e.g., a Radio Base Station (RBS), which in some networks is also called "NodeB" or "B node". A cell is a geographical area where radio coverage is provided by base station equipment at a base station site. Each cell is identified by an identity within the local radio area, which is broadcast in the cell. The base station communicates over the air interface operating on radio frequencies with the UEs within range of the base stations.

In some versions, particularly earlier versions of the RAN, several base stations are typically connected, e.g., by landlines or microwave, to a Radio Network Controller (RNC). The RNC, also sometimes termed a Base Station Controller (BSC), supervises and coordinates various activities of the plural base stations connected thereto. The radio network controllers are typically connected to one or more core networks.

The Universal Mobile Telecommunications System (UMTS) is a third generation mobile communication system, which evolved from the Global System for Mobile Communications

(GSM), and is intended to provide improved mobile communication services based on Wideband Code Division Multiple Access (WCDMA) access technology. UTRAN is essentially a radio access network using wideband code division multiple access for user equipment units (UEs). The Third Generation Partnership Project (3GPP) has undertaken to evolve further the UTRAN and GSM based radio access network technologies.

Long Term Evolution (LTE) is a variant of a 3GPP radio access technology wherein the radio base station nodes are connected directly to a core network rather than to RNCs. In general, in LTE the functions of the RNC node are performed by the RBSs. As such, the RAN of an LTE system has an essentially "flat" architecture comprising RBSs without reporting to RNCs. In LTE networks the base station(s) is/are called eNodeB(s) or eNB(s).

3GPP is in the process of defining solutions for Minimizing Drive Tests (MDT). The intention of the Minimizing Drive Tests (MDT) work is documented in 3GPP TR 36.805 V9.0.0 (2009-12), 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on Minimization of drive-tests in Next Generation Networks (Release 9).

Stage 2 of Minimizing Drive Tests (MDT) is currently being developed in TS 37.320, i.e., 3GPP TS 37.320, "Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2". MDT Stage 2 includes a UE measurement logging function and immediate reporting function. The 3GPP TS 37.320 document essentially focuses on the UE measurement logging function.

An important use case for MDT is coverage optimization. For this purpose following UE measurements, or similar functionalities, are considered for UE-internal logging: Periodic, e.g. one every 5s, downlink pilot signal strength measurements; a serving cell becomes worse than threshold; transmit power headroom becomes less than threshold; Paging Channel Failure i.e. Paging Control CHannel (PCCH) decode error; and Broadcast Channel failure.

The network can request the UE to perform logging of measurements. The UE executes measurements and logs these measurements internally in a sequential manner, containing, e.g., some hour of logged measurement information.

As described in Fig. 1, the UE indicates to the network if it has available log i.e. available logged measurements. The network node i.e. eNB/RNC determines if it should request the logged measurements or not. If it decides to do so then a request is sent to the UE to deliver the

log in a report message. From the eNB/RNC, the reported logged measurements may further be sent to an OAM server or similar.

The current 3GPP assumptions on this log (i.e. logged measurements) feature are, e.g., as follows: the UE is required to maintain only one log at a time; one log only contains measurement information collected in one Radio Access Technology (RAT); a log can only be reported and indicated when the UE is in connected state; If UE is requested to start logging, e.g., by configuration, a possibly old log and configuration stored in UE is erased.

What the logged measurement report message in signal number 4 in Fig. 1 should look like has not yet been decided, as of the filing of this application. Some proposals for management of measurement report have been proffered.

As one example proposal for management of measurement reports, it has been suggested that a log i.e. logged measurements, are to be sent in a single packet, and keeping that single packet within the size limits of a Packet Data Convergence Protocol (PDCP) Protocol Data Unit (PDU). Keeping the single packet within the size limits of a PDCP PDU makes it possible to use a Radio Resource Control RRC message for reporting without being segmented into several smaller packets before being sent to the receiving node i.e., the eNB or NB/RNC in LTE or UMTS, respectively. One option of this proposal would be limiting the maximum size of a log in a UE to one RRC message that fits into one PDCP payload packet.

As another example proposal for management of measurement reports, it has been suggested to send a log i.e. a logged measurement that is larger than a RRC message with several RRC messages.

However, there are disadvantages to both example proposals mentioned above. For example, limiting the log size could prevent logging to complete for the whole configured run time i.e. logging duration, which can be several hours. The log could fill the limited log buffer in the UE before any measurement report has been possible to send to the network node. Before the configured logging duration time has ended, the UE would stop the logging so that to only allow the log size to be a single packet e.g. single RRC packet, and relevant measurements reports may not thereafter be logged. Also in the current MDT configuration a start time for the logging is not configurable. This means that for a prolonged logging campaign a long period between logging instances may be needed in the MDT configuration, alternatively new MDT

configuration needs to be provided from the OAM periodically to be conveyed to MDT capable UEs.

For the other proposal, sending too many RRC packets in a row could, in poor radio environments or when handover would occur, create problems with the radio connections and could also create unnecessary radio link failures that will make the users suffer and logged data be lost.

SUMMARY

The technology disclosed herein concerns network based control of report messages comprising logged measurements in a wireless communications network, which overcomes at least some of the above mentioned disadvantages and which allows multiple partial report messages to be sent.

In accordance with some example embodiments, a UE that has stored logged data i.e. logged measurements that are bigger than a single transmission packet, i.e. report message, segments the data and sends only a portion of the data that fits into a single report message, and also indicates that more logged measurements exists at the UE.

In a first example of embodiment, there is disclosed a method in a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The method comprises sending a request to the UE to start transmitting logged measurements in a report message. The network node then receives the report message comprising the logged measurements from the UE, and determines if the received report message comprises an indicator of additional logged measurements not yet transmitted, and if so, decides if the additional logged measurements need to be requested.

In a second example of an embodiment there is disclosed a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The network node comprises a network node communications interface and a network node processor circuit. The network node communications interface being configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements. The network node

processor circuit being configured to determine if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, to decide if the additional logged measurements need to be requested.

In a third example of an embodiment, there is disclosed a method in a User Equipment, UE, for assisting in network based control of report messages in a wireless communications network. The UE is being in connection with a serving network node and configured to transmit report messages to the network node upon request. The UE is further configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer as logged measurements. The method comprising: receiving a request, in the UE, from the network node to start transmitting logged measurements in a report message; determining if the logged measurements fit in the report message; and if not, including in the report message an indicator of additional logged measurements not yet transmitted; and, transmitting the report message, comprising the indicator, to the network node as a response to the request.

In a fourth example of an embodiment, there is disclosed a User Equipment, UE, for assisting in a network based control of report messages in a wireless communications network. The UE is being in connection with a serving network node and is configured to transmit report messages to the network node. The UE is further configured to periodically perform radio condition measurements and store the periodically performed measurements in a buffer as logged measurements. The UE comprises a UE communications interface and a UE processor circuit. The UE communications interface is configured to receive a request from the network node to start transmitting logged measurements in a report message, and to transmit the report message comprising the logged measurements. The UE processor circuit is configured to determine if the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

An advantage achieved by some of the above mentioned embodiments is that due to use of indicator in report message of further remaining logged measurements providing the network, i.e. a network node, with information needed to decide a timing of transmission of the logged measurements and a timing of when more logged measurements should be requested.

Another advantage achieved by at least some of the above mentioned embodiments is to make it possible to have longer logging duration and/or conduct more frequent measurements without overflow in log memory in UE e.g. UE buffer.

Another advantage achieved by some of the above mentioned embodiments is to provide the network node with information about logged measurements making it possible to determine the amount of logged measurements kept in a UE.

The foregoing and other objects, features, and advantages will become apparent from following more particular descriptions of preferred embodiments and aspects of embodiments as will be illustrated by accompanying drawings in which reference characters refer to the same parts throughout various views.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings are not necessarily to scale, emphasis instead being placed upon illustrating principles of the disclosure.

Fig. 1 is a signaling scheme illustrating how logged measurements are reported according to prior art.

Fig. 2 is a schematic block diagram illustrating example embodiments of a network node and a user equipment.

Fig. 3 is a flowchart depicting an example embodiment of a method in a network node.

Fig. 4 is a flowchart depicting further example embodiments of a method in a network node.

Fig. 5 is a flowchart depicting an example embodiment of a method in a user equipment.

Fig. 6 is a flowchart depicting further example embodiments of a method in a network node.

DETAILED DESCRIPTION

Fig. 2 illustrates portions of an example embodiment of a communications system/network, and particularly portions of a Radio Access Network (RAN) **20** comprising at least one network node **28** and a wireless terminal, hereinafter denoted User Equipment, (UE) **30**. Depending on a particular type of RAN utilized and delegation of nodal responsibilities, the

network node 28 may be a base station node e.g., an NodeB in UMTS or an eNodeB in Long Term Evolution (LTE)) or a Radio Network Controller (RNC) node in UMTS. Thus, the UE 30 communicates over radio interface **32** with the network node 28, either directly over radio interface 32 with the network node 28 in case of the network node 28 being a base station type node, or over the radio interface 32 and through a base station in the case of the network node 28 being a radio network controller (RNC) node or an Mobility Management Entity (MME) which is a control node which processes signaling between the UE and the Core Network (CN) and provides Visitor Location Register (VLR) functionality for the Evolved Packet System (EPS).

As mentioned above, the UE 30 can be a mobile station such as a mobile telephone ("cellular" telephone) or laptop with wireless capability (e.g., mobile termination), and thus can be, for example, a portable, pocket, hand-held, computer-included, or car-mounted mobile device which communicates voice and/or data via radio access network.

In accordance with one of its aspect, the technology disclosed concerns generation and/or transmission and/or use of multiple partial report messages with logged measurements such as MDT log packets, also denoted MDT log or MDT log data. As such, Fig. 2 shows an example embodiment of network node 28 or UE 30, which comprises a UE communication interface **42** and a UE processor circuit **40**. Note that the UE may be seen as a serving point. The UE processor circuit may include a buffer **44**, i.e. UE buffer, for storing logged measurements, not shown in figure, and in another embodiment the buffer 44 is within the UE 30.

Fig. 2 also illustrates network node 28 as comprising a network node processor circuit **50** and network node communications interface **52** (i.e. a communications interface of the network node). The network node processor circuit 50 may be, or comprise, a logged measurements requestor/processor (not shown in figure) to be used for requesting logged measurements, such as MDT log, in report message(s).

According to one example of an embodiment, the network node 28 is used for network based control of report messages comprising logged measurements in a wireless communications network, the network node 28 being configured to serve the UE 30, UE, and to receive report messages from the UE 30.

Continuing with the description of Fig. 2, the network node communications interface 52 is, or may be, configured to send request(s) to the UE 30 to start transmitting logged measurement(s) in report message(s), and to receive the report message(s) comprising the logged measurements. The logged measurements may comprise one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

According to one embodiment, the network node communications interface 52 may be configured to receive, from the UE 30, an indication of existents of logged measurements that are available. Note, that the "additional logged measurements" indicator is conveyed in the UE information report message while the indication of logged measurements available is conveyed in already existing/specified signaling.

According to one embodiment, the network node communications interface 52 may be configured to request the report message(s) directly from the UE 30 or from another network node, e.g. RNC, MME, RBS or other similar node.

According to one embodiment, the network node communications interface 52 may be configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node. The request may for example be a RRC connection request. The network node communications interface 52 may also be configured to receive a network node message from the other network node i.e. another eNodeB, RNC or RBS, comprising UE specific information. The UE specific information may further comprise the indicator indicating additional logged measurements not yet transmitted.

The network node processor circuit 50, mentioned above in relation to Fig.2, is configured to determine if the received report message(s) comprises an indicator of additional logged measurement(s) not yet transmitted; and if so, to decide if the additional logged measurements need to be requested. According to one embodiment, the network node processor circuit 50 may be configured to decide if the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc.

According to one embodiment, the network node processor circuit 50 may be configured to determine if the indicator indicates that there are logged measurements in a UE buffer 44 that do, or do not, fit in a single subsequent report message.

According to one embodiment, the network node processor circuit 50 may be configured to decide to request all the logged measurements in the buffer 44 of the UE in one subsequent request, or repeatedly upon receiving each report message. The decision may also be based on received status information of the buffer 44 in the UE 30 being for example overloaded. Note that configured to or adapted to in relation to functionality of circuits and devices mentioned above and throughout the whole disclosure are expressions that may be used having a similar or same meaning.

It should be appreciated that the network node processor circuit 50 may comprise an MDT log requestor/processor 50' (not shown in Fig. 2) which may be implemented in platform fashion, e.g., implemented by a computer/processor executing instructions of non-transient signals and/or by a circuit.

Likewise from a UE perspective, reference made to Fig. 2, the UE 30 may be, or is, used for assisting in network based control of report messages comprising logged measurements in a wireless communications network. The UE 30 is being in connection with the serving network node 28 and is configured to transmit report message(s) to the network node 30. The UE 30 may further be configured to periodically perform radio condition measurements and store the periodically performed measurements in the buffer 44 as logged measurements. Such logged measurements may be MDT log reports.

The UE communications interface 42 mentioned above in relation to Fig. 2, is configured to receive a request from the network node 28 to start transmitting logged measurements in report message(s), and to transmit/send the report message(s) comprising the logged measurements. The UE processor circuit 40 is configured to determine if the logged measurements fits in the report message(s), and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

According to one embodiment of an example implementation of a UE 30 in which the UE processor circuit 40 may be, or may comprise, a multiple partial MDT log reporter **40'** (Fig. 2 dashed lines). The multiple partial MDT log reporter 40' may comprise a log report generator

and data logging unit (not shown in Fig. 2). The multiple partial MDT log reporter 40' works in conjunction with a measurement unit (not shown in Fig. 2), and stores records of measurements in data logging unit. The log report generator may further comprise a packet identifier generator and "more data" i.e. additional data, flag generator.

The technology disclosed above, and in relation to some of the earlier mentioned embodiments, includes support for logged measurements, or an MDT log size, which exceeds a maximum size of the report message which may for example be a Packet Data Convergence Protocol (PDCP) packet. The technology disclosed herein also introduces and provides an indication from the UE 30 of additional logged measurements or MDT log data that remains in the UE buffer 44. In accordance with some example embodiments, a UE 30 that has stored logged measurements, sometimes denoted logged data, that are bigger than a single report message i.e. transmission packet, segments the logged measurements, and sends only a portion of the logged measurements that fits into a single report message. The UE 30 also indicates that more logged measurements exist at the UE 30 in the buffer 44. This indication of further remaining logged measurements allows the network node 28 to decide a timing of transmission of the logged measurements and a timing of when more logged measurements should be requested. This may for example depend on radio condition measurements or UE buffer status information.

The UE 30 will take a part of the logged measurements and put into the payload of the report message. The UE 30 will, if more logged measurements are still available, set a "more" or "additional" bit indicating to the network node 28, or by other means indicate to the network node 28, that there are more logged measurements available in the UE 30. The network node 28 will then, when it believes more data should be obtained e.g. based on: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc., request more logged measurements. When a request is done then the process may be repeated. A new decision may be taken after a new report message is received, and so on. In other words, upon reception of indication from UE, the network node 28 takes a decision (based on current radio conditions, node capacity) whether the network node 28 shall request more logged measurements "data" from the UE now or request it at a later point in time. This "later point in time" could be predefined e.g. 15s later. In one example an internal algorithm may for instance check to see if no Hand Over (HO) is imminent or other more vital procedure is at hand. The report messages

may be lost if unsuccessfully reporting happens just before a HO. In one example, the network node 28 may be configured to continue requesting reporting of logged measurements (MDT logs) in report messages until there are no more logged measurements to report.

An example of an embodiment of a method that may be implemented in the network node 28 is illustrated by **Fig. 3**. The method is used for network based control of report messages comprising logged measurements in a wireless communications network. According to the method, the network node 28 which is being configured to serve a UE 30, receives report messages from the UE 30 as mentioned above in relation to Fig. 2. More particularly, the method comprises: sending **S62** a request to the UE to start transmitting logged measurements in a report message; receiving **S64** the report message comprising the logged measurements; determining **S66** if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, deciding **S68** if the additional logged measurements need to be requested.

Yet an example of an embodiment of a method for implementation in the network node 28 is illustrated by **Fig. 4**. The general steps i.e. **S72, S74, S76** and **S78** correspond to S62-S68 mentioned above. In this example method comprises the network node 28 first receiving **S71**, e.g. from the UE 30, an indication of existents of logged measurements that are available i.e. the UE buffer 44 is not empty or more data exists in UE buffer 44. Note that this indication is different from the indicator indicating additional logged measurements.

According to the method, the network node 28 decides to send S72 request to the UE 30 to start reporting and receives S74 a report message as a response. The network node 28 then determines if the report message, which also comprises logged measurements and reporting time stamp, comprises an indicator of additional logged measurements not yet reported. If so, the network node 28 may decide S78 to request these additional logged measurements and therefore restarts at S72. If no indicator is included, the network node 28 will await **S77** a new indication S71, and restarts the procedure at S72. The network node 28 upon deciding S78 to request additional logged measurements may decide to request **S79** all logged measurements in one decision instead of requesting one subsequent report message at a time. In some example embodiments, if the UE 30 indicates that more than one reporting message is needed for the logged measurements in its UE buffer 44, several bits may then be used to indicate that. The

network node 28 may then choose to request multiple messages if the network node 28 so wants.

From a UE perspective, and an example of an embodiment which illustrates a method in a UE, reference is now made to **Fig. 5**. The UE 30 is configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer 44 as logged measurements. The method in the UE 30 for assisting in network based control of report messages comprising logged measurements in a wireless communications network, comprises: receiving **S82** a request from the network node 28 to start transmitting logged measurements in a report message; determining **S84** if the logged measurements fit in the report message; and if not, including **S86** in the report message an indicator of additional logged measurements not yet transmitted; and, transmitting **S88** the report message, comprising the indicator, to the network node 28 as a response to the request (S62; S72).

In an example of an embodiment and UE mode, the technology disclosed herein encompasses the following acts and capabilities, as illustrated by **Fig. 6**:

S90: UE periodically performs measurements and logs radio condition measurements, and possibly detailed positioning information of the UE 30, and stores the measurements as logged measurements in the UE buffer 44 i.e. in internal memory of the UE 30.

According to one embodiment the logged measurements in UE buffer 44 may be built up as "records" that include a "time stamp" indicating the time when the radio measurement was taken i.e. "measurement time stamp" and logged measurements. The record may optionally also include detailed position information of the UEs geographical position. The "records" may have variable size. The size of the logged measurements, sometimes denoted log size, in UE buffer 44 may be bigger than is possible to fit into one single report message to be sent from UE to network node.

S92: When the UE 30 receives a request from the network node 28 to start transmitting/reporting logged measurements, the UE 28 takes the number of "records" i.e. logged measurements, from the UE buffer 44 i.e. internal log, typically in the order of storage, that fits into the report message, and "advances" an internal pointer such that next-stored "records" will be included in the next report message next time the UE 30 is requested to report logged measurements.

This step, i.e. S92, may be preceded by that the UE 30 sending **S91** an indication to the network node 28 making it aware of logged measurements that are available at the UE 28.

S94: Upon receiving (S92) a request to start transmitting the UE 30 then determines if the logged measurements fit in a single report message or not.

If the logged measurements fit in one report message then no indicator is added or a dedicated bit for the indicator is left empty i.e. null is sent in that bit. Alternatively, an indication is added giving that no more information is available.

S96: In case the UE 30 has more logged measurements ("records") stored in the UE buffer 44 not yet reported an indicator of "additional logged measurements" i.e. more data exist is included in the report message.

A "Time stamp" value i.e. "Reporting time stamp" or other identifier is added to the report message at report message transmission. Alternatively, instead of including a reporting time stamp into the report message, a sequence number, stepped by one with each report message transmission may be used. Note that this reporting time stamp is different from the measurement time stamp added upon performing and logging the measurement.

S98: The UE 30 then transmits the report message, including oldest logged measurements obtained from UE buffer 44, to the network node 28 as a response to the request. The report message may therefore comprise logged measurements, a reporting time stamp and detailed positioning information of the UE 30.

S99: The UE 30 then deletes the transmitted/reported logged measurements from its buffer, i.e. UE buffer 44, and "advances" an internal pointer such that next-stored "records" will be included in the next report message. After receiving a new request from the network node 28 the UE 30 may then transmit/report logged measurements i.e. repeat steps S92-S99 and include new logged measurements i.e. "records", from the UE buffer 44, according to its internal pointer. Alternatively, or in combination with the reporting, the UE 30 may start again at step S90.

Note, that in current "MDT" general implementation the logging of measurements as logged measurements may only be done when UE is in "idle" state and the sending of logged

measurements (MDT logs) in report messages may only be done when the UE is in "connected" state.

In some example embodiments, if the UE buffer 44 is almost full or if a size limitation is to be reached, the UE 30 may indicate such conditions to the network node 28 during the sending S91 or adding that information during S96 and sending it during S98. The network node 28 may then prioritize the retrieval of logged measurements in order not to stop logging and/or loose logged measurements.

During the repeated sequence of messages between the UE 30 and the network node 28, to convey complete logged measurements from the UE 30 to the network node 28, there may be a need to change cell and/or serving Base Station (BS) e.g. during a handover form a first BS (eNB1; NB1; RNC1; RBS1) to a second BS (eNB1; NB1; RNC1; RBS1).

One way to handle cell change and/or BS change situations is that the UE indicate availability when it is connects to the second BS, e.g. according to S91 of Fig. 6. Thus the UE 30 being served by a first BS (e.g. eNB1) and which has for example sent two report messages to first BS, when performing a handover starts by sending an indication, i.e. sends S91 indication of logged measurements available, to second BS (e.g. eNB2) and then upon request starts reporting to second BS a third report message. Logged measurements that are sent in first and second report messages are generally deleted from UE buffer 44 and therefore not longer available.

A second way, or alternative, to handle this situation is that the information that the first BS (e.g. eNB1) has received with respect to "logged measurements available" as of step S91, is transferred to second BS (e.g. eNB2). The information is transferred based on a request from second BS or automatically, including any related information like trace references, etc. The idea here is to include the "indication" in already existing/specified handover preparation signaling (between eNB1 and eNB2) that is "preparing" the eNB2, before the UE is actually handed over (commanded) from eNB1 to eNB2.

In some situations, "trace references" and "logged measurements available" indication (S91) may be forwarded between RAN 20 nodes. In such cases, the UE 30 may also include the trace references in the report message when the UE 30 transmits a first report message to a RAN

node after handover. Note that this first report message, as of the example mentioned above in relation to the first way of handling the situation, would be the third report message.

Thus, the technology disclosed herein, in one of its aspects, supports and/or facilitates a log size exceeding a maximum size of a reporting message e.g. a PDCP packet. If the reporting loss/performance is considered an issue and needs to be addressed, while a restriction of a UEs total log size, in UE buffer or UE memory, is not wanted, then the UE that has stored logged measurements i.e. logged data, that is bigger than a single payload PDU (e.g due to PDCP restriction) may segment the logged measurements and send only a part that fits into a single report message/packet e.g., a message size in the UE response message has a fixed size while the MDT log itself has another limit e.g. UE buffer size restriction in UE 30 etc. To handle this, an indication in the report message e.g. the UE MDT log report, on that additional/more logged measurements exists is provided. This allows the network node 28 to decide the timing for when measurements should be requested and/or (re-)configured. Relying on the "report available bit" only would require that the UE again transients to RRC connected which may delay the transfer of logged measurements further, possibly involving UE log memory being exhausted, new logged MDT configuration or Hand Over (HO) to other Radio Access Technology (RAT) etc.

Thus, with a report message size restriction, the UE 30 shall be able to partition the logged measurements into a maximum fixed size reporting message e.g. an RRC message.

Currently the RRC message for MDT also carries information for RACH optimization (SON) and other optionally configured information. One consequence of the presence of other information in the RRC message/PDU using a size restriction would be that it possibly depends on the RRC message construction and configuration, or that the maximum size of a report message is always set according to a worst case scenario.

In view of the reasons above, no special handling of the RRC message/log size might be needed as a result of MDT. Retaining normal handling of RRC messages etc simplifies the considerations that need to taken in the network node 28 and UE 30.

The technology disclosed herein affords several advantages. Among the advantages are the following. The technology allows for long logging run times that may create large logged measurements sizes while the network node 28 controls the reporting time. The technology

facilitates that the network node 28 may determine an appropriate time of reporting without loosing logged measurements.

In the above description, for purposes of explanation and not limitation, specific details are set forth such as particular architectures, interfaces, techniques, etc. in order to provide a thorough understanding. However, it will be apparent to those skilled in the art that the above mentioned embodiments may be practiced in a ways that depart from these specific details. That is, those skilled in the art will be able to devise various arrangements which, although not explicitly described or shown herein, embody the principles of the embodiments and are included within their spirit and scope. In some instances, detailed descriptions of well-known devices, circuits, and methods are omitted so as not to obscure the description of the present embodiments with unnecessary detail. All statements herein reciting principles, aspects, and embodiments, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

Thus, for example, it will be appreciated by those skilled in the art that block diagrams of Fig. 2 herein may represent conceptual views of illustrative circuitry or other functional units embodying the principles of the technology. Similarly, it will be appreciated that any flow charts as of Fig. 3- Fig. 6, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

Functions of various elements including functional blocks of Fig. 2, including but not limited to those labeled or described as "computer", "processor" or "controller", may be provided through the use of hardware such as circuit hardware and/or hardware capable of executing software in the form of coded instructions stored on computer readable medium. Thus, such functions and illustrated functional blocks are to be understood as being either hardware-implemented and/or computer-implemented, and thus machine-implemented.

In terms of hardware implementation, the functional blocks of network node 28 or UE 30 may include or encompass, without limitation, Digital Signal Processor (DSP) hardware, reduced instruction set processor, hardware (e.g., digital or analog) circuitry including but not limited to

Application Specific Integrated Circuit(s) [ASIC], and (where appropriate) state machines capable of performing such functions.

In terms of computer implementation, a computer is generally understood to comprise one or more processors or one or more controllers, and the terms computer and processor and controller may be employed interchangeably herein. When provided by a computer or processor or controller, the functions may be provided by a single dedicated computer or processor or controller, by a single shared computer or processor or controller, or by a plurality of individual computers or processors or controllers, some of which may be shared or distributed. Moreover, use of the term "processor" or "controller" shall also be construed to refer to other hardware capable of performing such functions and/or executing software, such as the example hardware recited above.

In the example of Fig. 5 the platform depicted by line 70 has been illustrated as computer-implemented or computer-based platform. Another example platform for wireless terminal 70(5) can be that of a hardware circuit, e.g., an application specific integrated circuit (ASIC) wherein circuit elements are structured and operated to perform the various acts described herein.

Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. It will be appreciated that the scope of the present invention fully encompasses other embodiments which may become obvious to those skilled in the art, and that the scope of the present invention is accordingly not to be limited. Reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described embodiments that are known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed hereby. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it to be encompassed hereby.

CLAIMS

1. Method in a network node for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the UE (30), the method comprising:

   - sending (S62) a request to the UE to start transmitting logged measurements in a report message;

   - receiving (S64) the report message comprising logged measurements;

   - determining (S66) if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so,

   - deciding (S68) if the additional logged measurements are to be requested.

2. The method according to claim 1, wherein the method comprises receiving (S71), from the UE, an indication of existents of logged measurements that are available.

3. The method according to any of claims 1 or 2, wherein the logged measurements comprises one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); and broadcast channel failure(s).

4. The method according to any preceding claim, wherein the report message is received directly from the UE or via another network node.

5. The method according to any preceding claim, wherein the deciding (S68) is based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc.

6. The method according to any preceding claim, wherein the determining (S66) comprises determining if the indicator indicates that there is logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

7. The method according to claim 6, wherein the deciding (S68) comprises deciding (S79) to request all the logged measurements in the buffer of the UE in one subsequent request.

8. The method according to any preceding claim, wherein the method comprises receiving a previously sent report message from another network node(s), automatically or upon request.

9. The method according to any preceding claim, wherein the sending of a request is initiated by a UE handover procedure from another network node to the network node.

10. The method according to claim 9, wherein the method comprises receiving a network node message from the other network node comprising UE specific information.

11. The method according to claim 10, wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

12. A network node (28) for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the user equipment (30), the network node comprises:

- a network node communications interface (52) configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements;

- a network node processor circuit (50) configured to determine if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, to decide if the additional logged measurements need to be requested.

13. The network node (28) according to claim 12, wherein the network node communications interface (52) is configured to receive, from the UE, an indication of an existents of logged measurements that are available.

14. The network node (28) according to any of claims 12 or 13, wherein the logged measurements comprises one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit

power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

15. The network node (28) according to any of claims 12 to 14, wherein the network node communications interface (52) is configured to request the report message directly from the UE or from another network node.

16. The network node (28) according to any of claims 12 to 15, wherein the network node processor circuit (50) is configured to decide if the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc..

17. The network node (28) according to any of claims 12 to 16, wherein the network node processor circuit (50) is configured to the determine if the indicator indicates that there is logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

18. The network node (28) according to claim 17, wherein the network node processor circuit (50) is configured to decide to request all the logged measurements in the buffer (44) of the UE in one subsequent request.

19. The network node (28) according to any of claims 12 to 18, wherein the network node communications interface (52) is configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node.

20. The network node (28) according to claim 19, wherein the network node communications interface (52) is configured to receive a network node message from the other network node comprising UE specific information.

21. The network node (28) according to claim 19 wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

22. Method in a User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a

serving network node (28) and configured to transmit report messages to the network node (30) upon request, and wherein the UE (30) is configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer (44) as logged measurements, the method comprising:

- receiving (S82) a request from the network node (28) to start transmitting logged measurements in a report message;
- determining (S84) if the logged measurements fit in the report message; and if not,
- including (S86) in the report message an indicator of additional logged measurements not yet transmitted; and,
- transmitting (S88) the report message, comprising the indicator, to the network node (28) as a response to the request.

23. The method according to claim 22, wherein the including comprises including a reporting time stamp in the report message.

24. The method according to any of claims 22 or 23, wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

25. The method according to any of claims 22 to 24, wherein the logged measurements that are oldest in the buffer are reported first.

26. A User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a serving network node (28) and configured to transmit report messages to the network node (30), and wherein the UE (30) is configured to periodically perform radio condition measurements and store the periodically performed measurements in a buffer as logged measurements, the UE (30) comprises:

- a UE communications interface (42) configured to receive a request from the network node (28) to start transmitting logged measurements in a report message, and to transmit the report message comprising the logged measurements;

- a UE processor circuit (40) configured to determine if the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

27. The User Equipment (30) according to claim 26, wherein the UE processor circuit (40) is configured to add a reporting time stamp to the reporting message.

28. The User Equipment (30) according to any of claims 26 or 27 wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

29. The User Equipment (30) according to any of claims 26 to 28, wherein the logged measurements that are oldest in the buffer are transmitted first.

30. The User equipment (30) according to any of claims 26 to 29, wherein the logged measurements are Minimizing Drive Tests, MDT, log data.

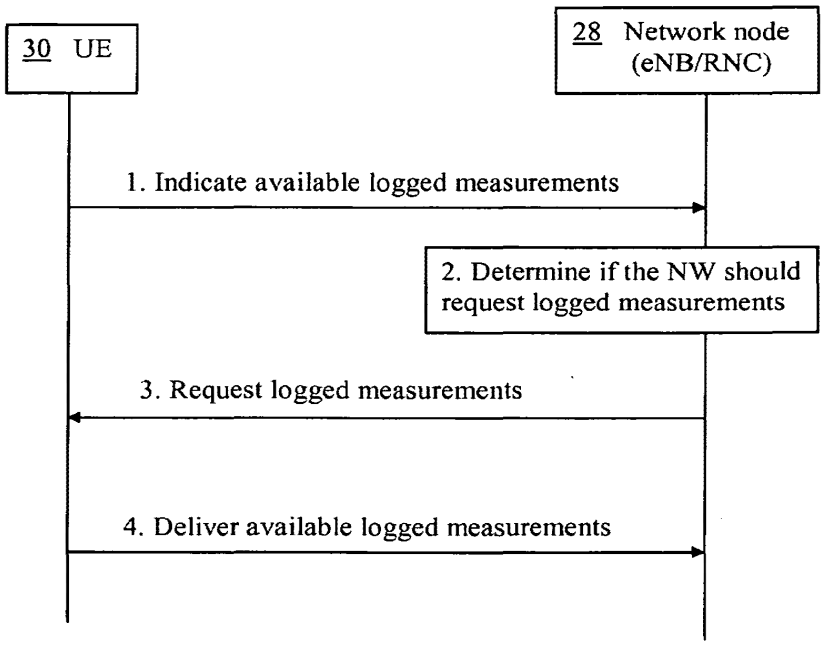

Fig. 1 (Prior art)

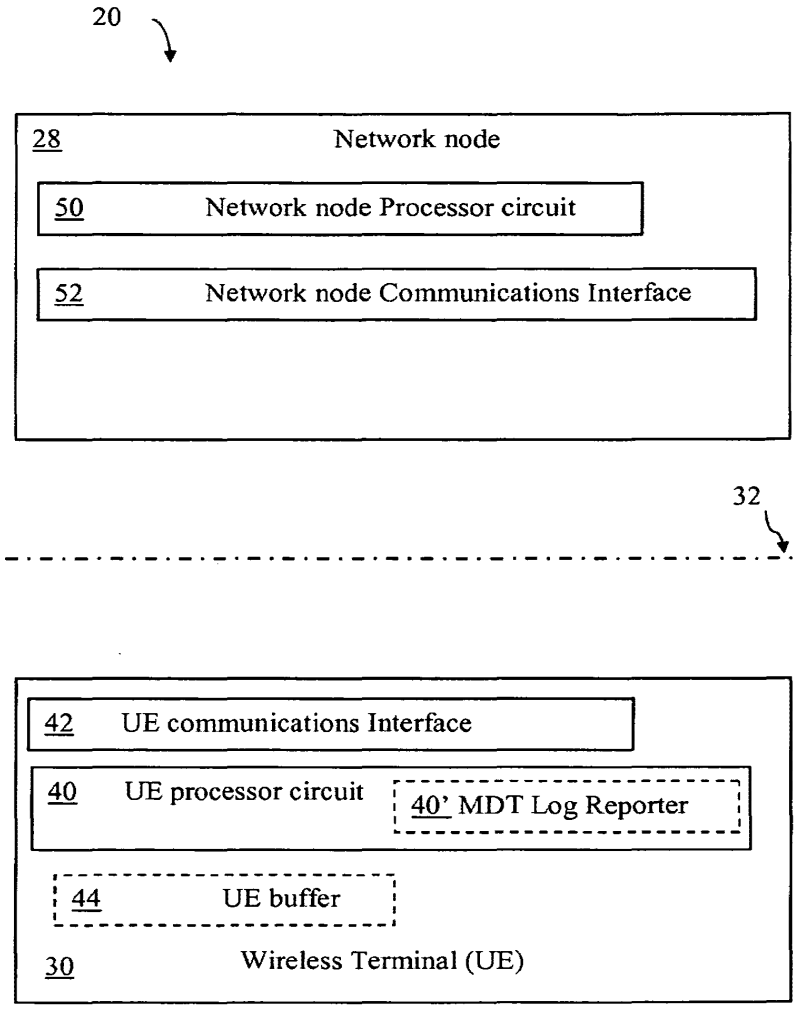
20
28
Network node
50
Network node Processor circuit
52
Network node Communications Interface
32
42
UE communications Interface
40
UE processor circuit
40' MDT Log Reporter
44
UE buffer
30
Wireless Terminal (UE)

Fig. 2

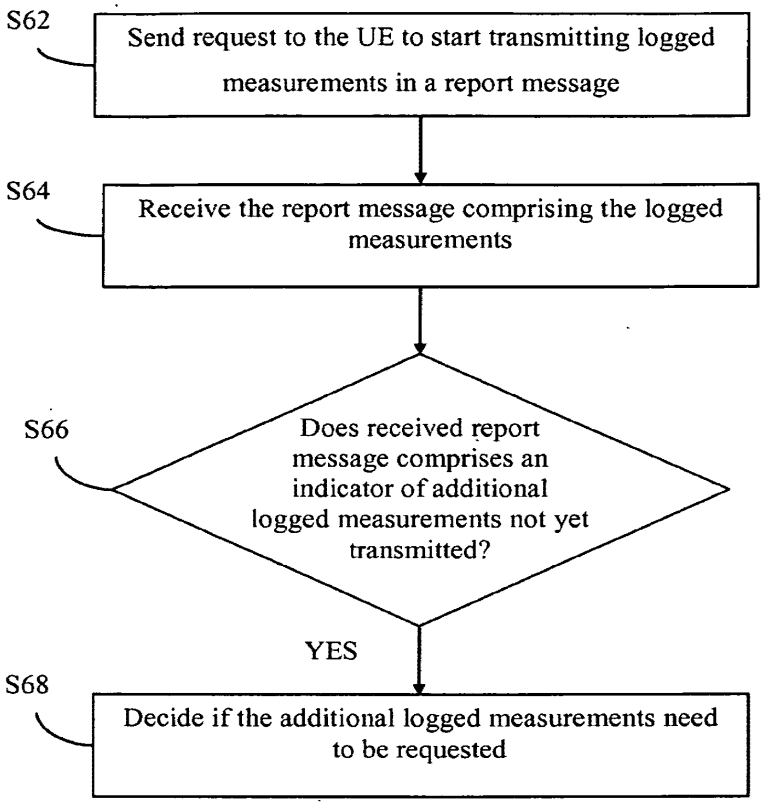
S62
Send request to the UE to start transmitting logged measurements in a report message
S64
Receive the report message comprising the logged measurements
S66
Does received report message comprises an indicator of additional logged measurements not yet transmitted?
YES
S68
Decide if the additional logged measurements need to be requested

Fig. 3

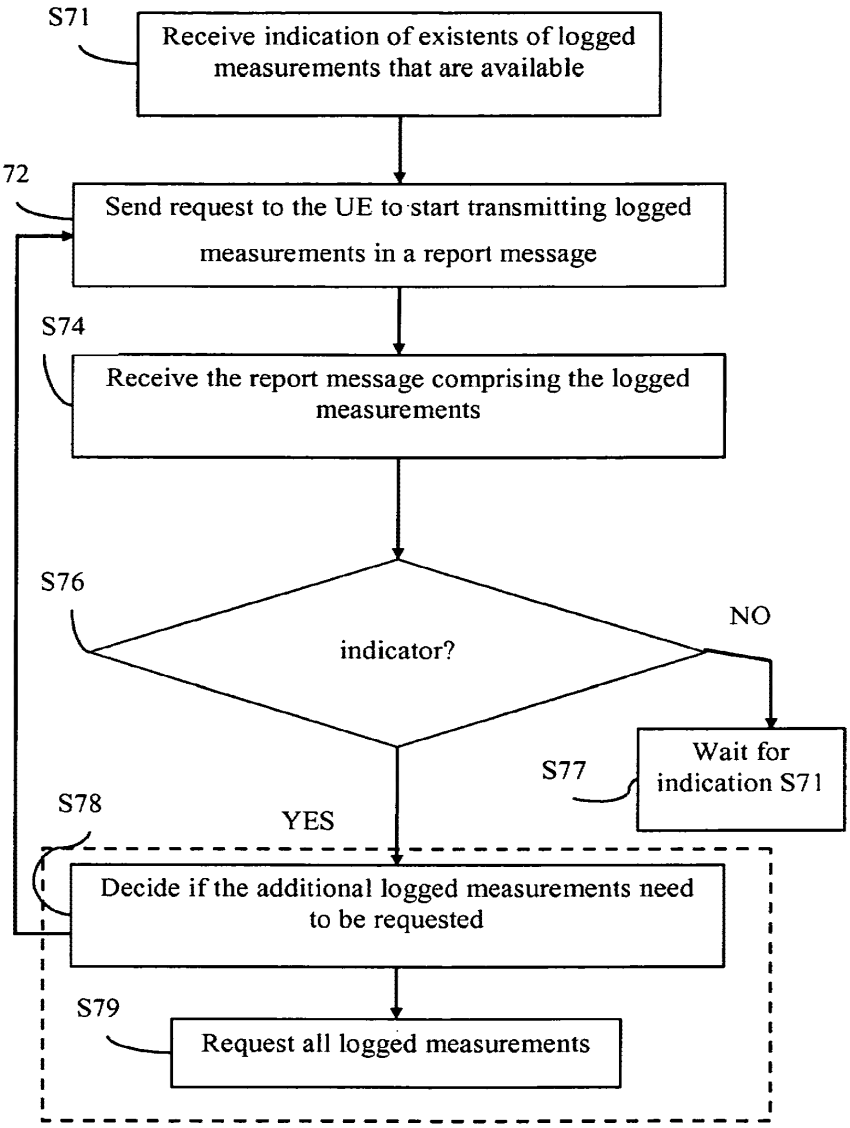
S71
Receive indication of existents of logged measurements that are available
S72
Send request to the UE to start transmitting logged measurements in a report message
S74
Receive the report message comprising the logged measurements
S76
indicator?
NO
S77
Wait for indication S71
S78
YES
Decide if the additional logged measurements need to be requested
S79
Request all logged measurements

Fig. 4

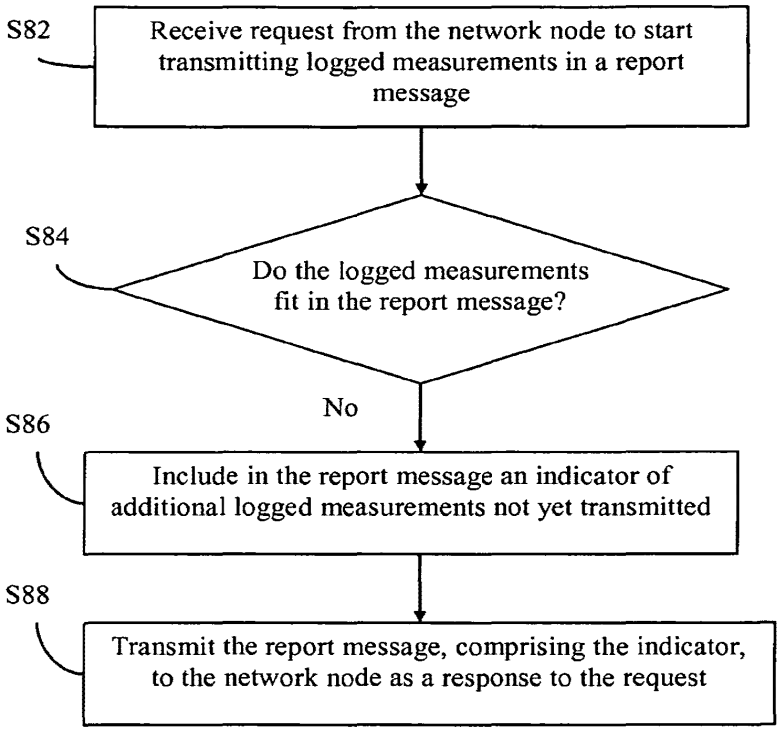
S82
Receive request from the network node to start transmitting logged measurements in a report message
S84
Do the logged measurements fit in the report message?
No
S86
Include in the report message an indicator of additional logged measurements not yet transmitted
S88
Transmit the report message, comprising the indicator, to the network node as a response to the request

Fig. 5

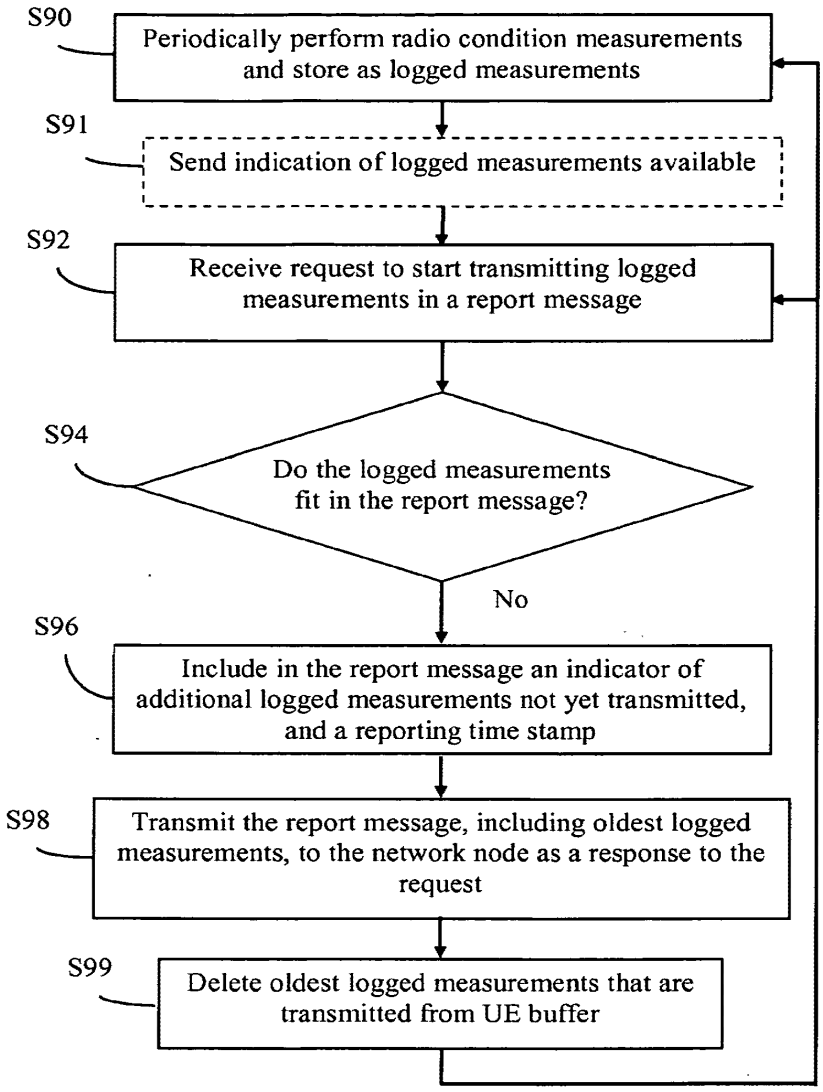
S90
Periodically perform radio condition measurements and store as logged measurements
S91
Send indication of logged measurements available
S92
Receive request to start transmitting logged measurements in a report message
S94
Do the logged measurements fit in the report message?
No
S96
Include in the report message an indicator of additional logged measurements not yet transmitted, and a reporting time stamp
S98
Transmit the report message, including oldest logged measurements, to the network node as a response to the request
S99
Delete oldest logged measurements that are transmitted from UE buffer

Fig. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2010/051355

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W24/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04W

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ERICSSON ET AL: "Further details on logged MDT measurement reporting", 3GPP DRAFT; R2-103086 LOGGED REPORTING FOR MDT, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Montreal, Canada; 20100510, 4 May 2010 (2010-05-04), XP050423249, [retrieved on 2010-05-04] paragraphs [02.2], [5.1.3]	1-30
A	US 2006/165188 A1 (WUNDER GERHARD [DE] ET AL) 27 July 2006 (2006-07-27) abstract paragraphs [0023] - [0036]	1-30

-/--

[X] Further documents are listed in the continuation of Box C.

[X] 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
4 May 2011	12/05/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Pasini, Enrico

Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KYOCERA: "Inter-RAT MDT data retrieval and MDT (re)-configuration", 3GPP DRAFT; R2-104813, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Madrid, Spain; 20100823, 17 August 2010 (2010-08-17), XP050451954, [retrieved on 2010-08-17] paragraphs [0001] - [02.1]	1-30
A	KYOCERA: "Logged MDT reporting Indication", 3GPP DRAFT; R2-103173, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Montreal, Canada; 20100510, 4 May 2010 (2010-05-04), XP050423279, [retrieved on 2010-05-04] pages 1-2	1-30
X,P	NOKIA SIEMENS NETWORKS ET AL: "Logged MDT reporting when roaming", 3GPP DRAFT; R2-106238, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Jacksonville, USA; 20101115, 9 November 2010 (2010-11-09), XP050467064, [retrieved on 2010-11-09] paragraph [5.1.1.3]	1-30
X,P	HUAWEI ET AL: "some update proposal for 37.320", 3GPP DRAFT; R2-106198 SOME UPDATE PROPOSAL FOR 37.320, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Jacksonville, USA; 20101115, 7 November 2010 (2010-11-07), XP050465646, [retrieved on 2010-11-07] paragraph [5.1.1.3.3]	1-30

-/--

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2010/051355

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	"3rd Generation Partnership Project;Technical Specification Group TSG RANUniversal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA);Radio measurement collection for Minimization of Drive Tests (MDT);Overall description; Stage 2(Release 10)", 3GPP DRAFT; 37.320-110, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Xi'an; 20101011, 15 October 2010 (2010-10-15), XP050463033, [retrieved on 2010-10-15] paragraph [5.1.1.3] -----	1-30

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/SE2010/051355

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006165188 A1	27-07-2006	CN 1812353 A	02-08-2006
		EP 1699197 A1	06-09-2006
		JP 2006211651 A	10-08-2006

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SE2010/051355	09.12.2010	04.10.2010

International Patent Classification (IPC) or both national classification and IPC
INV. H04W24/10

Applicant
TELEFONAKTIEBOLAGET L M ERICSSON (PUBL)

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- ☒ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	see form PCT/ISA/210	Pasini, Enrico Telephone No. +49 89 2399-6968

Form PCT/ISA/237 (Cover Sheet) (July 2009)

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing filed or furnished:

   a. (means)

      ☐ on paper

      ☐ in electronic form

   b. (time)

      ☐ in the international application as filed

      ☐ together with the international application in electronic form

      ☐ subsequently to this Authority for the purposes of search

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-30
	No:	Claims	
Inventive step (IS)	Yes:	Claims	
	No:	Claims	1-30
Industrial applicability (IA)	Yes:	Claims	1-30
	No:	Claims	

2. Citations and explanations

see separate sheet

Box No. VI Certain documents cited

1. Certain published documents (Rules 43*bis*.1 and 70.10)

   and / or

2. Non-written disclosures (Rules 43*bis*.1 and 70.9)

   see form 210

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Cited Documents

The following documents are referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1 : 3GPP R2-103086

D2 : WO 2006 / 016690 A1

D3 : 3GPP R2-104813

D4 : 3GPP R2-103173

and also

D5 : 3GPP R2-106238 (P doc)

D6 : 3GPP R2-106198 (P doc)

D7 : 3GPP TS.37320 V1.1.0 (P doc)

Re Item VIII

Certain observations on the international application

The **claims** do not meet the requirements of **clarity** (Article 6 PCT) for the following reasons.

1.

The formulation of **dependent claims 2 and 13** unclearly (Article 6 PCT) refers to "an indication of **existents** of logged measurements".

2.

The formulation of **dependent claims 5 and 16** unclearly (Article 6 PCT) refers to "one or more of the following measurement...**etc.**", thus leaving **entirely undefined** which **other** alternatives are, possibly, meant to be covered by said **claims**.

3.

The **vague and imprecise statements in the description** on page 16 (see in particular lines 6-9: "that is, those skilled in the art...included within their spirit and scope"; lines 11-15: "all statements herein reciting principles...equivalents developed in the future...any elements developed that perform the same function regardless of structure") and on page 17 (see in particular lines 19-21: "it will be appreciated...accordingly not to be limited" and lines 23-25: "all structural and functional equivalents...incorporated herein by reference and are intended to be

encompassed thereby") imply that the subject-matter for which protection is sought may be different to that **defined by the claims**, thereby resulting in **lack of clarity** (Article 6 PCT) when used to interpret them.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

The above **clarity objections** (Item VIII) notwithstanding, the **claims** do not meet the requirements of the Article 33 PCT for the following reasons.

1.

Document D1 discloses (see in particular paragraphs 2.2. and 5.1.3), according to **the essential features of claim 1** a method in a network node for network based control of report messages in a wireless communications network, the network node being configured to serve a user equipment UE, and to receive report messages from the UE (see in particular paragraphs 2.2 an 5.1.3) the method comprising:

- sending a request to the UE to start transmitting logged measurements in a report message (see in particular 5.1.3: *"measurement reporting is triggered by UE information request message"*);

- receiving the report message comprising logged measurements (see in particular 2.2: "*log transmitted in several segments"* and 5.1.3 *"logged measurement reports")*;

- determining if **a received message** comprises an indicator of additional logged measurements not yet transmitted; and if so (see in particular 2.2: *"fragmentation of the logged data"; "log is transmitted in several segments"; "the UE simply indicates available data whenever it has logged data"*),

- deciding if the additional logged measurements are to be requested (see in particular 5.1.3: *"the network can decide to retrieve the logged data based on this indication"*).

Difference: The subject-matter of **claim 1** differs from **D1 merely** in that it **further defines** determining if the received **report message** comprises an indicator of additional logged measurements not yet transmitted.

Effect: The **technical effect** of said **difference** is that of providing the indication that more logged data are available **using less radio resources.**

Problem: Thus, the **objective technical problem** to be solved by the present invention can be regarded as **how to provide indicator signalling more efficiently.**

Obviousness: However, starting from the segmented transmission of logged data of **D1** already disclosing the transmision of a corresponding indicator, the fact that an indication of additional logged measurements not yet transmitted can be **efficiently transmitted** by placing it **within a measurement report message** would merely represents a straightforward implementation detail **for the skilled person**.

Moreover, this minor detail is **anyway already normally known in the art in order to improve signalling efficiency**, see e.g. **D2** (see in particular the abstract and [0023]-[0024]: *"channel quality **measurements**"; "these measurements are **stored at mobile terminals**"; "the mobile terminals are generating **reports** comprising a indication of the channel quality";* [0029]-[0036]: *"additional reports refine the channel quality information sent in the first report"; "**a field** in the report indicates the mobility grade"; "base station should be able to **deduce from the field** mobility grade **how many additional reports** will follow"*).

Thus, the subject-matter of **claim 1** does not involve an inventive step (Article 33(3) PCT).

2.

The same observations as in V-1 above are applicable to the corresponding subject-matter of **independent claims 12, 22 and 26**

Therefore, the subject-matter of **independent claims 12, 22 and 26 also** does not involve an inventive step (Article 33(3) PCT).

3.

Dependent claims 2-11, 13-21, 23-15, 27-30 do not contain any additional features which, in combination with the features of any claim to which they refer, meet the requirements of the Article 33(3) PCT in respect of **inventive step**, because they are either already **derivable in principle from the cited documents** or represent **obvious design possibilities** for a person skilled in the field of wireless communications, as derivable e.g. from

a) **D1** (see the already cited passages),

b) **D2** (see the already cited passages)

and also

c) **D3** (see in particular paragraphs 1, 2, 2.1, option 1 & 2).

d) **D4** (see in particular pages 1-2).

Therefore, **dependent claims 1-11, 13-21, 23-15, 27-30** do not meet the requirements of the Article 33(3) PCT.

Re Item VII

Certain defects in the international application

1.

The **independent claims** are not in the two-part form recommended by Rule 6.3 (b) PCT, which in the present case would be appropriate, having a pre-characterizing portion which reflects the prior-art of **document D1**(Rule 6.3(b) (I) PCT) and with the remaining features being included in a characterising part (Rule 6.3(b)(ii) PCT).

2.

Contrary to the requirements of Rule 5.1(a)(ii) PCT, the relevant background art disclosed in the cited **documents D1 to D3** is not mentioned in the description, nor are the relevant contents of these documents discussed therein.

3.

The vague (see Item VIII above) statement of **incorporation by reference** on page 17 (see line 25) has, additionally, the consequence that the application is not self contained (PCT Guidelines 4.27).

Re Item VI

Certain documents cited

1.

Documents **D5, D6, D7** are 3GPP documents published in the priority interval of the present application and they disclose a method for network based control of report messages as in the present application:

a) **D5** (see in particular paragraph 5.1.1.3 and sub-paragraphs),

b) **D6** (see in particular paragraph 5.1.1.3 and sub-paragraphs),

c) **D7** (see in particular paragraph 5.1.1.3 and sub-paragraphs).

Thus, the disclosure of **any of D4, D5 or D6** would become relevant in respect of the requirements of the Article 33 PCT in case the **claimed priority date** of 04.10.2010 turns out not to be **validly claimed**.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference P32817WO1	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/SE2010/051355	International filing date *(day/month/year)* 09.12.2010	Priority date *(day/month/year)* 04.10.2010

International Patent Classification (IPC) or national classification and IPC
INV. H04W24/10

Applicant
Telefonaktiebolaget L M Ericsson (publ)

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 9 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 14 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and/or sheets containing rectifications authorized by this Authority, unless those sheets were superseded or cancelled, and any accompanying letters (see Rules 46.5, 66.8, 70.16, 91.2, and Section 607 of the Administrative Instructions).
      ☐ sheets containing rectifications, where the decision was made by this Authority not to take them into account because they were not authorized by or notified to this Authority at the time when this Authority began to draw up this report, and any accompanying letters (Rules 66.4bis, 70.2(e), 70.16 and 91.2).
      ☐ superseded sheets and any accompanying letters, where this Authority either considers that the superseding sheets contain an amendment that goes beyond the disclosure in the international application as filed, or the superseding sheets were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in item 4 of Box No. I and the Supplemental Box (see Rule 70.16(b)).
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3*bis* of Annex C of the Administrative Instructions).

4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☒ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of invention
   - ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - ☒ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☒ Box No. VIII Certain observations on the international application

Date of submission of the demand	Date of completion of this report
03.08.2012	21.12.2012
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Fax: +49 89 2399 - 4465	Authorized officer Pasini, Enrico Telephone No. +49 89 2399-6968

Form PCT/IPEA/409 (Cover Sheet) (July 2011)

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3(a) and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4(a))
   - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a) and (b))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-3, 5-15	as originally filed
4, 4a, 16, 17	filed with telefax on 16-10-2012

Claims, Numbers

27-30	as originally filed
1-26	filed with telefax on 16-10-2012

Drawings, Sheets

1/6-6/6	as originally filed

   ☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:

5. ☐ This report has been established:
   - ☐ taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91 (Rules 66.1(d-bis) and 70.2(e)).
   - ☐ without taking into account the rectification of an obvious mistake authorized by or notified to this Authority under Rule 91(Rules 66.4bis and 70.2(e)).

6. ☐ Supplementary international search report(s) from Authority(ies) has/have been received and taken into account in establishing this report (Rule 45bis.8(b) and (c)).

Box No. II Priority

1. ☐ This report has been established as if no priority had been claimed due to the failure to furnish within the prescribed time limit the requested:
   - ☐ copy of the earlier application whose priority has been claimed (Rule 66.7(a)).
   - ☐ translation of the earlier application whose priority has been claimed (Rule 66.7(b)).

2. ☐ This report has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rule 64.1). Thus for the purposes of this report, the international filing date indicated above is considered to be the relevant date.

3. Additional observations, if necessary:

   see separate sheet

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-26
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-26
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-26
	No:	Claims	

2. Citations and explanations (Rule 70.7):

   see separate sheet

Box No. VI Certain documents cited

1. Certain published documents (Rule 70.10)

   and / or

2. Non-written disclosures (Rule 70.9)

   see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Cited Documents

The following documents are referred to in this communication; the numbering will be adhered to in the rest of the procedure:

D1: 3GPP R2-103086

D2: WO 2006 / 016690 A1

D3: 3GPP R2-104813

D4: 3GPP R2-103173

and also

D5 : 3GPP R2-106238 (P doc)

D6 : 3GPP R2-106198 (P doc)

D7 : 3GPP TS.37320 V1.1.0 (P doc)

Re Item I

Basis of the report

1.

The **amendment filed** with the telefax of 16.10.2012 introduces subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT.

Amended claims 18 and 22 define, in a **same** *"report message"* the presence of two **separate** information elements as *"indicator of additional logged measurements"* and *"indicator of a UE buffer state condition"*. From the **original description and claims**, however, it is **only derivable**, directly and unambiguously, that:

a) *"The logged measurements may comprise one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition"*;

b) *"The network node processor circuit... may be configured to decide if the additional logged measurements need to be requested based on...UE buffer state condition"*;

c) *"The network node processor circuit may be configured to decide to request all the logged measurements in the buffer of the UE in one subsequent request, or repeatedly upon receiving each report message. The decision may also be based on received status information of the buffer"*;

d) *"The UE will, if more logged measurements are still available, set a "more" or "additional" bit indicating to the network node or by other means indicate to the network node, that there are more logged measurements available" and "the network node will then, when it believes more data should be obtained e.g. based on: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc."*

I.e. while it is indeed disclosed that retrieval of the additional logged measurements can be based on a *"received buffer state indication"*, there is instead **no indication** from which it is **directly and unambiguously** derivable that this should or might be received in a **same report message** as the *"indicator of additional logged measurements"*, as instead claimed in the **amended claims 18 and 22.**

Re Item VIII

Certain observations on the international application

The **claims** do not meet the requirements of **clarity** (Article 6 PCT) for the following reasons.

1.

Despite the objection under Item I above, the fact that the UE sends *"status information of the buffer"* in addition to the *"additional logged measurements indicator"* represents an **essential feature** of the invention **at the UE side** as defined in **claims 1 and 10** in order to achieve the effect of the invention over the prior-art (see the Applicant's letter page 3 = permit a decision by the network on the retrieval based on UE-related conditions).

Similarly, deciding whether the additional logged measurements are to be requested based, among others, on the *"UE buffer state condition"* has been correctly defined in **claims 1 and 10**. However, in the absence of any corresponding feature defining that this *"buffer state condition"* information is also **received** from the UE by the network node, it is left unclear (Article 6 PCT) how this **decision** can possibly be **achieved**.

Thus, **claims 1 and 10** do not define **all the essential features** of the invention and, in any case, are not clearly (Article 6 PCT) defined in terms of the **same or corresponding special technical features** as defined in **claims 18 and 22.**

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1.

Document D1 discloses (see in particular paragraphs 2.2. and 5.1.3), according to **the essential features of claim 1** a method in a network node for network based control of report messages in a wireless communications network, the network node being configured to serve a user equipment UE, and to receive report messages from the UE (see in particular paragraphs 2.2 an 5.1.3) the method comprising:

- sending a request to the UE to start transmitting logged measurements in a report message (see in particular 5.1.3: *"measurement reporting is triggered by UE information request message"*);

- receiving the report message comprising logged measurements (see in particular 2.2: *"log transmitted in several segments"* and 5.1.3 *"logged measurement reports")*.

In **D1** (see in particular 2.2) fragmentation of the logged data is applied whereby the log is transmitted in several segments.

Difference: The subject-matter of **claim 1 explicitly defines** determining if **a received message comprises an indicator** of additional logged measurements not yet transmitted; and if so deciding if the additional logged measurements are to be requested based on **an additional condition**: interference, radio condition measurements, available resources, capacity or UE buffer state condition.

Effect / Problem: The **technical effect** and the resulting **problem** of said **difference** is that of providing **a more flexible measurement data mechanism**.

Obviousness: **D1** already clearly indicates the **principles** that a) transmission of the log can be segmented and b) the UE indicates when log data are available. It would be, thus, entirely evident that a **normal implementation option** is to provide an explicit indication, in case of segmentation, that there are still logged data.

However, it appears that the subsequent step of deciding the retrieval of the data **based on this information and the additional conditions** defined in **claim 1** would not be disclosed or derivable from the cited documents. In particular:

D2 discloses (see in particular the abstract and [0023]-[0024]) channel quality measurements stored at mobile terminals wherein the mobile terminals are generating reports. Additional reports refine the channel quality information sent in the first report and a field in the report indicates the mobility grade. The base station deduces from the field mobility grade how many additional reports will follow. However, **D2** does not hint to the retrieval of remaining **already logged** data based on an additional condition.

D3 (see in particular paragraphs 1, 2, 2.1, option 1 & 2) indicates availability of MDT data with one bit and the network can decide to retrieve the data based on this indication. A retrieve bit can be used to retrieve any remaining MDT logged data or the NB may choose not to retrieve the data. However, there is no hint to the retrieval of remaining data based on a corresponding indication and an additional condition as in **claim 1**.

D4 (see in particular pages 1-2) discloses various implementation option, with the hint to retrieval of partial logs of MDT.

Thus, the subject-matter of **claim 1** meets the requirements of the Article 33 PCT.

2.

Similar observations as in V-1 above are applicable to the corresponding subject-matter of **independent claims 18** and, with similar reasoning, to **claims 10 and 22,** relating to the provision of additional logged data **and,** additionally, of buffer state information.

Therefore, the subject-matter of **independent claims 10, 18 and 22 also** meets the requirements of the Article 33 PCT.

Re Item VI

Certain documents cited

1.

Documents **D5, D6, D7** are 3GPP documents published in the priority interval of the present application and they disclose a method for network based control of report messages based on the explicit indication that MDT log data were not completely transferred according to the **same principle** of the present application.

a) **D5** (see in particular paragraph 5.1.1.3 and sub-paragraphs),

b) **D6** (see in particular paragraph 5.1.1.3 and sub-paragraphs),

c) **D7** (see in particular paragraph 5.1.1.3 and sub-paragraphs).

Buffer status reporting, as defined in **claims 18 and 22** (see also Item I above) is normally known in the art. Thus, the disclosure of **any of D4, D5 or D6** would become relevant in respect of the requirements of the Article 33(3) PCT in case the **claimed priority date** of 04.10.2010 turns out not to be **validly claimed.**

Re Item II

Priority

1.

The priority has been considered provisionally valid as the priority document was not yet available to the IPEA at the time of establishment of this written opinion.

August 3, 2012

VIA FAX (+49 89 2399-4465)

European Patent Office
D-80298 Munich
GERMANY
Attention: Enrico Pasini, Authorized Officer

RE: NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK
Applicant: Telefonaktiebolaget LM Ericsson (publ)
PCT Appl.: PCT/SE2010/051355
Filed: 09 December 2010
Our Ref.: P32817WO1
RESPONSE TO WRITTEN OPINION

Dear Sir:

In response to the Written Opinion dated 12 May 2011, Applicant respectfully requests the Examiner to reconsider the claims of this application in view of the amendments and comments set forth below.

Enclosures

- Replacement claim pages numbered 18-22, containing claims 1-26 (renumbered)(in triplicate).
- Replacement description pages numbered 4, 4a, 16, and 17 (in triplicate).

Summary of Written Opinion

The ISA set forth a reasoned statement with regard to claims 1-30 of the patent application. Claims 1-30 were found to lack inventive step in view of Documents D1-D4. Independent claims 1, 12, 22, and 26 were found to lack inventive step in view of Document D1 (3GPP R2-103086) and D2 (WO 2006/016690 A1). The dependent claims were found to lack inventive step in view of D1, D2, D3 (3GPP R2-104813) and D4 (3GPP R2-103173).

Summary of Amendments

Original claims 1-30 have been amended and renumbered as claims 1-26. Substitute pages 18-22 include claims 1-26 as amended and renumbered.

The background section of the description has been amended to add a brief discussion of cited documents D1-D3. Pages 16 and 17 have been amended to delete or rewrite several paragraphs reciting that the invention is not limited by the disclosed embodiments.

Re Item VIII

The Examiner objected to the claims and description for various clarity issues.

1. Claims 2 and 13 misspelled "existence" as "existents". Claims 2 and 13 have been cancelled, rendering this objection moot.

2. Claims 5 and 16 recited the unclear term "etc.". Claims 5 and 16 have been cancelled, rendering this objection moot. The claimed feature that originally recited "etc." has been incorporated into amended independent claims 1 and 10, and the "etc." has been deleted. Withdrawal of the objection is respectfully requested.

3. Pages 16 and 17 of the description contained several paragraphs reciting that the invention is not limited by the disclosed embodiments. The Applicant has amended pages 16 and 17 to delete the objectionable language. Withdrawal of the objection is respectfully requested.

Arguments Re Item V

The Examiner rejected independent claims 1, 12, 22, and 26 (renumbered as claims 1, 10, 18, and 22, respectively) for lacking inventive step in view of Document D1 and D2. Regarding claim 1, for example, the Examiner argued that D1 discloses sending a log of measurement reports in several segments, and thus the difference between D1 and the subject matter of claim 1 is that claim 1 recites that the UE includes in its report message, an indicator of additional logged measurements not yet transmitted. He further argued that D2 discloses a field in a channel quality report indicating a mobility grade from which the base station should be able to deduce how many additional reports will follow.

The Applicant notes that neither D1 nor D2 expressly disclose the UE including in its report message, an indicator of additional logged measurements not yet transmitted. D2 is cited for this purpose, but only discloses an indicator of a mobility grade from which the base station should be able to *deduce* how many additional reports will follow.

Furthermore, the Examiner has concentrated on a technical problem of how to provide indicator signaling more efficiently, and the technical effect of the invention being to use less radio resources. While this is a technical effect of the invention, it is not the only effect. For example, claim 1 also recites that the network node decides whether the additional logged measurements are to be requested. The Examiner cited section 5.1.3 of D1 for disclosing, "the network can decide to retrieve the logged data base on this indication." However, the indication referred to in this passage is the earlier indication sent by the UE to prompt the network to initially request the logged measurements. This process is shown in FIG. 1 and is acknowledged to be prior art. There is no disclosure in D1 of the network deciding to retrieve additional logged measurements that were not sent in the initial report.

A review of D1-D4 has not revealed any disclosure or suggestion of the network node deciding whether to request additional logged measurements indicated in a report message to be available. This feature is recited in independent claims 1, 12, 22, and 26, and has the technical effect of providing the network node with the flexibility to request the additional measurements or not. For example, the network node may decide not to request the measurements if radio resources are not currently available. Or the network node may decide to request the measurements if the UE indicates its buffer state is full. This feature is not disclosed or suggested by D1-D4. Therefore, the allowance of claims 1, 12, 22, and 26 is respectfully requested.

The Applicant has further amended independent claims 1 and 10 to recite that the network node decides whether the additional logged measurements are to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resources; network node capacity; and UE buffer state condition.

The fact that the UE may report its buffer state is disclosed in the description on page 8, lines 4-8. The fact that the network node considers interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resources; network node capacity; and UE buffer state condition is disclosed in the description on page 8, lines 27-31.

A review of D1-D4 has not revealed any disclosure or suggestion of the network node considering any of these factors when deciding whether to request additional logged measurements indicated in a report message to be available. Therefore, the allowance of amended claims 1 and 10 is respectfully requested.

Allowance of dependent claims 2-9, 11-17, 19-21, and 23-26 is requested due to their recitation of additional features in combination with the features of the independent claims.

Re Item VII

1. The Examiner objected to the independent claims for not being in two-part format. The Applicant has recast the independent claims in two-part format.

2. The Examiner objected to the description for not describing the background art disclosed in documents D1-D3. The Applicant has amended the background section of the description to briefly summarize D1-D3.

3. The Examiner objected to an incorporation by reference on line 25 of page 17. The Applicant has deleted this material.

Conclusion

For all the above reasons, the Applicant respectfully requests a favorable examination report for amended claims 1-26.

Respectfully submitted,

Friedrich Kühn
European Patent Attorney

configuration needs to be provided from the OAM periodically to be conveyed to MDT capable UEs.

For the other proposal, sending too many RRC packets in a row could, in poor radio environments or when handover would occur, create problems with the radio connections and could also create unnecessary radio link failures that will make the users suffer and logged data be lost.

Further details of the 3GPP proposals may be found in Ericsson et al., "Further details on logged MDT measurement reporting", 3GPP Draft, R2-103086, 4 May 2010 (measurement reports may be sent in segments) and in Kyocera, "Inter-RAT MDT data retrieval and MDT (re)-configuration", 3GPP Draft, R2-104813, 17 August 2010 (UE sends indicator of available logged MDT data).

Additionally, international patent application number WO 2006/016690 discloses a field in a channel quality report indicating a mobility grade from which the base station should be able to deduce how many additional reports will follow.

SUMMARY

The technology disclosed herein concerns network based control of report messages comprising logged measurements in a wireless communications network, which overcomes at least some of the above mentioned disadvantages and which allows multiple partial report messages to be sent.

In accordance with some example embodiments, a UE that has stored logged data i.e. logged measurements that are bigger than a single transmission packet, i.e. report message, segments the data and sends only a portion of the data that fits into a single report message, and also indicates that more logged measurements exists at the UE.

In a first example of embodiment, there is disclosed a method in a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The method comprises sending a request to the UE to start transmitting logged measurements in a report message. The network node then receives the report message comprising the logged measurements from the UE, and determines if the received report

message comprises an indicator of additional logged measurements not yet transmitted, and if so, decides if the additional logged measurements need to be requested.

In a second example of an embodiment there is disclosed a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The network node comprises a network node communications interface and a network node processor circuit. The network node communications interface being configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements. The network node

facilitates that the network node 28 may determine an appropriate time of reporting without loosing logged measurements.

It will be appreciated by those skilled in the art that block diagrams of Fig. 2 herein may represent conceptual views of illustrative circuitry or other functional units embodying the principles of the technology. Similarly, it will be appreciated that any flow charts as of Fig. 3-Fig. 6, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

Functions of various elements including functional blocks of Fig. 2, including but not limited to those labeled or described as "computer", "processor" or "controller", may be provided through the use of hardware such as circuit hardware and/or hardware capable of executing software in the form of coded instructions stored on computer readable medium. Thus, such functions and illustrated functional blocks are to be understood as being either hardware-implemented and/or computer-implemented, and thus machine-implemented.

In terms of hardware implementation, the functional blocks of network node 28 or UE 30 may include or encompass, without limitation, Digital Signal Processor (DSP) hardware, reduced instruction set processor, hardware (e.g., digital or analog) circuitry including but not limited to Application Specific Integrated Circuit(s) [ASIC], and (where appropriate) state machines capable of performing such functions.

In terms of computer implementation, a computer is generally understood to comprise one or more processors or one or more controllers, and the terms computer and processor and controller may be employed interchangeably herein. When provided by a computer or processor or controller, the functions may be provided by a single dedicated computer or processor or controller, by a single shared computer or processor or controller, or by a plurality of individual computers or processors or controllers, some of which may be shared or distributed. Moreover, use of the term "processor" or "controller" shall also be construed to refer to other hardware capable of performing such functions and/or executing software, such as the example hardware recited above.

In the example of Fig. 5 the platform depicted by line 70 has been illustrated as computer-implemented or computer-based platform. Another example platform for wireless terminal

70(5) can be that of a hardware circuit, e.g., an application specific integrated circuit (ASIC) wherein circuit elements are structured and operated to perform the various acts described herein.

As will be recognized by those skilled in the art, the innovative concepts described in the present application can be modified and varied over a wide range of applications. Accordingly, the scope of patented subject matter should not be limited to any of the specific exemplary teachings discussed above, but is instead defined by the following claims.

CLAIMS

1. A method in a network node for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the UE (30), wherein the network node sends a request to the UE to start transmitting logged measurements in a report message, and receives the report message comprising logged measurements, the method being characterized by the steps of:
   - determining (S66) whether the received report message includes an indicator of additional logged measurements not yet transmitted; and
   - when the received report message includes an indicator of additional logged measurements not yet transmitted, deciding (S68) whether the additional logged measurements are to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resources; network node capacity; and UE buffer state condition.

2. The method according to claim 1, wherein the logged measurements comprise one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of the UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); and broadcast channel failure(s).

3. The method according to claim 1 or 2, wherein the report message is received directly from the UE or via another network node.

4. The method according to any preceding claim, wherein the determining (S66) step comprises determining whether the indicator indicates that there are logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

5. The method according to claim 4, wherein the deciding (S68) step comprises deciding (S79) to request all the logged measurements in the buffer of the UE in one subsequent request.

6. The method according to any preceding claim, wherein the method comprises receiving a previously sent report message from another network node automatically or upon request.

7. The method according to any preceding claim, wherein the sending of a request is initiated by a UE handover procedure from another network node to the network node.

8. The method according to claim 9, wherein the method comprises receiving a network node message from the other network node comprising UE specific information.

9. The method according to claim 10, wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

10. A network node (28) for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the user equipment (30), wherein the network node includes a communications interface (52) configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements, wherein the network node is characterized by:

- a network node processor circuit (50) configured to determine whether the received report message includes an indicator of additional logged measurements not yet transmitted, and if so, to decide whether the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resources; network node capacity; and UE buffer state condition.

11. The network node (28) according to claim 10, wherein the logged measurements comprise one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of the UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

12. The network node (28) according to claim 10 or 11, wherein the network node communications interface (52) is configured to request the report message directly from the UE or from another network node.

13. The network node (28) according to any of claims 10 to 12, wherein the network node processor circuit (50) is configured to the determine whether the indicator indicates that there are logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

14. The network node (28) according to claim 13, wherein the network node processor circuit (50) is configured to decide to request all the logged measurements in the buffer (44) of the UE in one subsequent request.

15. The network node (28) according to any of claims 10 to 14, wherein the network node communications interface (52) is configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node.

16. The network node (28) according to claim 15, wherein the network node communications interface (52) is configured to receive a network node message from the other network node comprising UE specific information.

17. The network node (28) according to claim 15, wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

18. A method in a User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a serving network node (28) and configured to transmit report messages to the network node (30) upon request, and wherein the UE (30) is configured to periodically perform radio condition measurements, store the periodically performed measurements in a UE buffer (44) as logged measurements, and receive a request from the network node (28) to start transmitting logged measurements in a report message, the method being characterized by the steps of:

- determining (S84) if the logged measurements fit in the report message; and if not,
- including (S86) in the report message an indicator of additional logged measurements not yet transmitted and an indicator of a UE buffer state condition;
- transmitting (S88) the report message, including the indicator, to the network node (28) as a response to the request; and
- sending to the network node, an indication of a UE buffer state condition for use by the network node in deciding whether the additional logged measurements need to be requested.

19. The method according to claim 18, wherein the including comprises including a reporting time stamp in the report message.

20. The method according to claim 18 or 19, wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

21. The method according to any of claims 18 to 20, wherein the logged measurements that are oldest in the buffer are reported first.

22. A User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a serving network node (28) and configured to transmit report messages to the network node (30), and wherein the UE (30) is configured to periodically perform radio condition measurements, store the periodically performed measurements in a buffer as logged measurements, receive a request from the network node (28) to start transmitting logged measurements in a report message, and transmit the report message comprising the logged measurements, wherein the UE (30) is characterized by:

- a UE processor circuit (40) configured to determine whether the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted that there are additional logged measurements not yet transmitted; and
- a UE communications interface (42) configured to send to the network node (28), an indication of a UE buffer state condition for use by the network node in deciding whether the additional logged measurements need to be requested.

23. The User Equipment (30) according to claim 22, wherein the UE processor circuit (40) is configured to add a reporting time stamp to the reporting message.

24. The User Equipment (30) according to claim 21 or 22 wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

25. The User Equipment (30) according to any of claims 22 to 24, wherein the logged measurements that are oldest in the buffer are transmitted first.

26. The User equipment (30) according to any of claims 22 to 25, wherein the logged measurements are Minimizing Drive Tests, MDT, log data.

WO 2012/047141
PCT/SE2010/051355

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

SECOND AND SUPPLEMENTARY NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION (TO DESIGNATED OFFICES WHICH APPLY THE 30 MONTH TIME LIMIT UNDER ARTICLE 22(1))

(PCT Rule 47.1(c))

To:

HASSELGREN, Joakim
Ericsson AB
Patent Unit LTE
Torshamnsgatan 23
S-164 80 Stockholm
SUÈDE

Date of mailing *(day/month/year)* 07 February 2013 (07.02.2013)	
Applicant's or agent's file reference P32817WO1	IMPORTANT NOTICE

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SE2010/051355	09 December 2010 (09.12.2010)	04 October 2010 (04.10.2010)

Applicant
TELEFONAKTIEBOLAGET L M ERICSSON (PUBL) et al

1. **ATTENTION**: For any designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002 (30 months from the priority date), **does not apply**, please see Form PCT/IB/308(First Notice) issued previously.

2. Notice is hereby given that the following designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002, **does apply**, has/have requested that the communication of the international application, as provided for in Article 20, be effected under Rule 93*bis*.1. The International Bureau has effected that communication on the date indicated below:
12 April 2012 (12.04.2012)

AU, AZ, BY, CN, CO, DZ, EP, HU, KG, KP, KR, MD, MK, MY, MZ, NA, NG, PG, RU, SY, TM, US

In accordance with Rule 47.1(c-*bis*)(i), those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

3. The following designated Offices, for which the time limit under Article 22(1), as in force from 1 April 2002, **does apply**, have not requested, as at the time of mailing of the present notice, that the communication of the international application be effected under Rule 93*bis*.1 :

AE, AG, AL, AM, AO, AP, AT, BA, BB, BG, BH, BR, BW, BZ, CA, CH, CL, CR, CU, CZ, DE, DK, DM, DO, EA, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, ID, IL, IN, IS, JP, KE, KM, KN, KZ, LA, LC, LK, LR, LS, LT, LY, MA, ME, MG, MN, MW, MX, NI, NO, NZ, OA, OM, PE, PH, PL, PT, RO, RS, SC, SD, SE, SG, SK, SL, SM, ST, SV, TH, TJ, TN, TR, TT, UA, UZ, VC, VN, ZA, ZM, ZW

In accordance with Rule 47.1(c-*bis*)(ii), those Offices accept the present notice as conclusive evidence that the Contracting State for which that Office acts as a designated Office does not require the furnishing, under Article 22, by the applicant of a copy of the international application.

4. **TIME LIMITS for entry into the national phase**

For the designated or elected Office(s) listed above, the applicable time limit for entering the national phase will, **subject to what is said in the following paragraph,** be **30 MONTHS** from the priority date.

In practice, **time limits other than the 30-month time limit** will continue to apply, for various periods of time, in respect of certain of the designated or elected Office(s) listed above. For **regular updates on the applicable time limits** (30 or 31 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at http://www.wipo.int/pct/en/index.html.

It is the applicant's **sole responsibility** to monitor all these time limits.

The International Bureau of WIPO
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WO 2012/047141
PCT/SE2010/051355

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

FIRST NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION (TO DESIGNATED OFFICES WHICH DO NOT APPLY THE 30 MONTH TIME LIMIT UNDER ARTICLE 22(1))

(PCT Rule 47.1(c))

To:

HASSELGREN, Joakim
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Patent Unit LTE
Torshamnsgatan 23
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SUÈDE

Date of mailing *(day/month/year)*	
10 May 2012 (10.05.2012)	
Applicant's or agent's file reference P32817WO1	**IMPORTANT NOTICE**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SE2010/051355	09 December 2010 (09.12.2010)	04 October 2010 (04.10.2010)

Applicant

TELEFONAKTIEBOLAGET L M ERICSSON (PUBL) et al

1. **ATTENTION**: For any designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002 (30 months from the priority date), **does apply**, please see Form PCT/IB/308(Second and Supplementary Notice) (to be issued promptly after the expiration of 28 months from the priority date).

2. Notice is hereby given that the following designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002, **does not apply**, has/have requested that the communication of the international application, as provided for in Article 20, be effected under Rule 93*bis*.1. The International Bureau has effected that communication on the date indicated below:
12 April 2012 (12.04.2012)

   None

   In accordance with Rule 47.1(c-*bis*)(i), those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

3. The following designated Offices, for which the time limit under Article 22(1), as in force from 1 April 2002, **does not apply**, have not requested, as at the time of mailing of the present notice, that the communication of the international application be effected under Rule 93*bis*.1 :

   LU, TZ, UG

   In accordance with Rule 47.1(c-*bis*)(ii), those Offices accept the present notice as conclusive evidence that the Contracting State for which that Office acts as a designated Office does not require the furnishing, under Article 22, by the applicant of a copy of the international application.

4. **TIME LIMITS for entry into the national phase**

   For the designated Office(s) listed above, and unless a demand for international preliminary examination has been filed before the expiration of **19 months** from the priority date (see Article 39(1)), the applicable time limit for entering the national phase will, **subject to what is said in the following paragraph,** be **20 MONTHS** from the priority date.

   In practice, **time limits other than the 20-month time limit** will continue to apply, for various periods of time, in respect of certain of the designated Offices listed above. For **regular updates on the applicable time limits** (20 or 21 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at http://www.wipo.int/pct/en/index.html.

   It is the applicant's **sole responsibility** to monitor all these time limits.

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Authorized officer

Nora Lindner

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From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING SUBMISSION, OBTENTION OR TRANSMITTAL OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

HASSELGREN, Joakim
Ericsson AB
Patent Unit LTE
Torshamnsgatan 23
S-164 80 Stockholm
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Date of mailing *(day/month/year)* 22 September 2011 (22.09.2011)	
Applicant's or agent's file reference P32817WO1	**IMPORTANT NOTIFICATION**
International application No. PCT/SE2010/051355	International filing date *(day/month/year)* 09 December 2010 (09.12.2010)
International publication date *(day/month/year)* **Not yet published**	Priority date *(day/month/year)* 04 October 2010 (04.10.2010)
Applicant TELEFONAKTIEBOLAGET L M ERICSSON (PUBL) et al	

The applicant is hereby notified of the date of receipt (or of obtaining by the International Bureau) of the priority document(s) relating to all earlier application(s) whose priority is claimed. Unless otherwise indicated by the letters "NR", in the right-hand column or by an asterisk appearing next to the date of receipt, **the priority document concerned was submitted or transmitted to or obtained by the International Bureau in compliance with Rule 17.1(a), (b) or (b-*bis*)**. This Form replaces any previously issued notification concerning submission, transmittal or obtaining of priority documents.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
04 October 2010 (04.10.2010)	61/389,581	US	05 September 2011 (05.09.2011)

The letters "NR" denote a priority document which, on the date of mailing of this Form, had not yet been received or obtained by the International Bureau in compliance with Rule 17.1(a), (b) or (b-*bis*). Where the applicant has failed to either submit, request to prepare and transmit or obtain and transmit, or to request the International Bureau to obtain the priority document within the applicable time limit under that Rule, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

An asterisk "*" next to a date of receipt, denotes a priority document submitted or transmitted to or obtained by the International Bureau but not in compliance with Rule 17.1(a), (b) or (b-*bis*) (the priority document was received after the time limit prescribed in Rule 17.1(a); the request to prepare and transmit the priority document was submitted to the receiving Office after the applicable time limit under Rule 17.1(b) or the request to the receiving Office or the International Bureau to obtain the priority document was made after the applicable time limit under Rule 17.1(b-*bis*)). Even though the priority document was not furnished in compliance with Rule 17.1(a), (b) or (b-*bis*), the International Bureau will nevertheless transmit a copy of the document to the designated Offices, for their consideration. In case such a copy is not accepted by the designated Office as the priority document, Rule 17.1(c) provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

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PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
P32817WO1		
International application No.	International filing date *(day/month/year)*	(Earliest) Priority Date *(day/month/year)*
PCT/SE2010/051355	09/12/2010	04/10/2010
Applicant		
TELEFONAKTIEBOLAGET L M ERICSSON (PUBL)		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 5 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      [X] the international application in the language in which it was filed
      [ ] a translation of the international application into _____, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. [ ] This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. [ ] With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.

2. [ ] **Certain claims were found unsearchable** (See Box No. II)

3. [ ] **Unity of invention is lacking** (see Box No III)

4. With regard to the **title,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established by this Authority to read as follows:

5. With regard to the **abstract,**
   [X] the text is approved as submitted by the applicant
   [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority

6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. 3
      [X] as suggested by the applicant
      [ ] as selected by this Authority, because the applicant failed to suggest a figure
      [ ] as selected by this Authority, because this figure better characterizes the invention
   b. [ ] none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No
PCT/SE2010/051355

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04W24/10
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
H04W

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	ERICSSON ET AL: "Further details on logged MDT measurement reporting", 3GPP DRAFT; R2-103086 LOGGED REPORTING FOR MDT, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Montreal, Canada; 20100510, 4 May 2010 (2010-05-04), XP050423249, [retrieved on 2010-05-04] paragraphs [02.2], [5.1.3]	1-30
A	US 2006/165188 A1 (WUNDER GERHARD [DE] ET AL) 27 July 2006 (2006-07-27) abstract paragraphs [0023] - [0036]	1-30

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[X] Further documents are listed in the continuation of Box C.

[X] 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
4 May 2011	12/05/2011

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Pasini, Enrico

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Form PCT/ISA/210 (second sheet) (April 2005)

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KYOCERA: "Inter-RAT MDT data retrieval and MDT (re)-configuration", 3GPP DRAFT; R2-104813, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Madrid, Spain; 20100823, 17 August 2010 (2010-08-17), XP050451954, [retrieved on 2010-08-17] paragraphs [0001] - [02.1]	1-30
A	KYOCERA: "Logged MDT reporting Indication", 3GPP DRAFT; R2-103173, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Montreal, Canada; 20100510, 4 May 2010 (2010-05-04), XP050423279, [retrieved on 2010-05-04] pages 1-2	1-30
X,P	NOKIA SIEMENS NETWORKS ET AL: "Logged MDT reporting when roaming", 3GPP DRAFT; R2-106238, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Jacksonville, USA; 20101115, 9 November 2010 (2010-11-09), XP050467064, [retrieved on 2010-11-09] paragraph [5.1.1.3]	1-30
X,P	HUAWEI ET AL: "some update proposal for 37.320", 3GPP DRAFT; R2-106198 SOME UPDATE PROPOSAL FOR 37.320, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Jacksonville, USA; 20101115, 7 November 2010 (2010-11-07), XP050465646, [retrieved on 2010-11-07] paragraph [5.1.1.3.3]	1-30

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P	"3rd Generation Partnership Project;Technical Specification Group TSG RANUniversal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA);Radio measurement collection for Minimization of Drive Tests (MDT);Overall description; Stage 2(Release 10)", 3GPP DRAFT; 37.320-110, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, vol. RAN WG2, no. Xi'an; 20101011, 15 October 2010 (2010-10-15), XP050463033, [retrieved on 2010-10-15] paragraph [5.1.1.3] -----	1-30

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/SE2010/051355

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2006165188 A1	27-07-2006	CN 1812353 A	02-08-2006
		EP 1699197 A1	06-09-2006
		JP 2006211651 A	10-08-2006

Form PCT/ISA/210 (patent family annex) (April 2005)

WO 2012/047141
PCT/SE2010/051355

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING
AVAILABILITY OF THE PUBLICATION
OF THE INTERNATIONAL APPLICATION

To:

HASSELGREN, Joakim
Ericsson AB
Patent Unit LTE
Torshamnsgatan 23
S-164 80 Stockholm
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Date of mailing *(day/month/year)*
12 April 2012 (12.04.2012)

Applicant's or agent's file reference
P32817WO1

IMPORTANT NOTICE

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SE2010/051355	09 December 2010 (09.12.2010)	04 October 2010 (04.10.2010)

Applicant
TELEFONAKTIEBOLAGET L M ERICSSON (PUBL) et al

The applicant is hereby **notified** that the International Bureau:

☒ has **published** the above-indicated international application on 12 April 2012 (12.04.2012) under No. WO 2012/047141

☐ has **republished** the above-indicated international application on under No. WO
For an explanation as to the reason for this republication of the international application, reference is made to INID codes (15), (48) or (88) (*as the case may be*) on the front page of the published international application.

A copy of the international application is available for viewing and downloading on WIPO's website at the following address: www.wipo.int/pctdb (in the appropriate field of the structured search, enter the PCT or WO number).

The applicant may also obtain a paper copy of the published international application from the International Bureau by sending an e-mail to patentscope@wipo.int or by submitting a written request to the contact details provided below.

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From the INTERNATIONAL BUREAU

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NOTIFICATION OF RECEIPT OF RECORD COPY

(PCT Rule 24.2(a))

To:

HASSELGREN, Joakim
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Patent Unit LTE
Torshamnsgatan 23
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SUÈDE

Date of mailing *(day/month/year)*	IMPORTANT NOTIFICATION
17 January 2011 (17.01.2011)	
Applicant's or agent's file reference	International application No.
P32817WO1	PCT/SE2010/051355

The applicant is hereby **notified** that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

TELEFONAKTIEBOLAGET L M ERICSSON (PUBL) (for all designated States except US)
ENBUSKE, Henrik et al (for US)

International filing date: 09 December 2010 (09.12.2010)
Priority date(s) claimed: 04 October 2010 (04.10.2010)
Date of receipt of the record copy by the International Bureau: 30 December 2010 (30.12.2010)
List of designated Offices:

AP: BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW
EA: AM, AZ, BY, KG, KZ, MD, RU, TJ, TM
EP: AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR
OA: BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG
National: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW

ATTENTION: The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau. **In addition, the applicant's attention is drawn to:**

- time limits for entry into the national phase (see www.wipo.int/pct/en/texts/time_limits.htmland *PCT Applicant's Guide*, National Phase, especially Chapters 3 and 4)
- requirements regarding priority documents (if applicable) (see *PCT Applicant's Guide*, International Phase, paragraph 5.070)

A copy of this notification is being sent to the receiving Office and to the International Searching Authority.

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NETWORK BASED CONTROL OF REPORT MESSAGES IN A WIRELESS COMMUNICATIONS NETWORK

TECHNICAL FIELD

This disclosure pertains to a method in a network node, a method in user equipment, a network node and user equipment in a wireless communications network. More particularly, there is provided mechanisms for network based control of report messages comprising logged measurements in a wireless communications network.

BACKGROUND

In a typical cellular radio system, wireless terminals, also known as mobile stations and/or User Equipments units (UEs), communicate via a Radio Access Network (RAN) to one or more core networks. The wireless terminals, hereinafter called UEs which is the same as User Equipments, can also be mobile telephones, i.e. "cellular" telephones, and laptops with wireless capability e.g., mobile termination, and thus are, for example, portable, pocket, hand-held, computer-included, or car-mounted mobile devices which communicate voice and/or data via the RAN.

The RAN normally covers a geographical area which is divided into cell areas, also denoted cells, with each cell area being served by a base station e.g., a Radio Base Station (RBS), which in some networks is also called "NodeB" or "B node". A cell is a geographical area where radio coverage is provided by base station equipment at a base station site. Each cell is identified by an identity within the local radio area, which is broadcast in the cell. The base station communicates over the air interface operating on radio frequencies with the UEs within range of the base stations.

In some versions, particularly earlier versions of the RAN, several base stations are typically connected, e.g., by landlines or microwave, to a Radio Network Controller (RNC). The RNC, also sometimes termed a Base Station Controller (BSC), supervises and coordinates various activities of the plural base stations connected thereto. The radio network controllers are typically connected to one or more core networks.

The Universal Mobile Telecommunications System (UMTS) is a third generation mobile communication system, which evolved from the Global System for Mobile Communications

(GSM), and is intended to provide improved mobile communication services based on Wideband Code Division Multiple Access (WCDMA) access technology. UTRAN is essentially a radio access network using wideband code division multiple access for user equipment units (UEs). The Third Generation Partnership Project (3GPP) has undertaken to evolve further the UTRAN and GSM based radio access network technologies.

Long Term Evolution (LTE) is a variant of a 3GPP radio access technology wherein the radio base station nodes are connected directly to a core network rather than to RNCs. In general, in LTE the functions of the RNC node are performed by the RBSs. As such, the RAN of an LTE system has an essentially "flat" architecture comprising RBSs without reporting to RNCs. In LTE networks the base station(s) is/are called eNodeB(s) or eNB(s).

3GPP is in the process of defining solutions for Minimizing Drive Tests (MDT). The intention of the Minimizing Drive Tests (MDT) work is documented in 3GPP TR 36.805 V9.0.0 (2009-12), 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on Minimization of drive-tests in Next Generation Networks (Release 9).

Stage 2 of Minimizing Drive Tests (MDT) is currently being developed in TS 37.320, i.e., 3GPP TS 37.320, "Radio measurement collection for Minimization of Drive Tests (MDT); Overall description; Stage 2". MDT Stage 2 includes a UE measurement logging function and immediate reporting function. The 3GPP TS 37.320 document essentially focuses on the UE measurement logging function.

An important use case for MDT is coverage optimization. For this purpose following UE measurements, or similar functionalities, are considered for UE-internal logging: Periodic, e.g. one every 5s, downlink pilot signal strength measurements; a serving cell becomes worse than threshold; transmit power headroom becomes less than threshold; Paging Channel Failure i.e. Paging Control CHannel (PCCH) decode error; and Broadcast Channel failure.

The network can request the UE to perform logging of measurements. The UE executes measurements and logs these measurements internally in a sequential manner, containing, e.g., some hour of logged measurement information.

As described in Fig. 1, the UE indicates to the network if it has available log i.e. available logged measurements. The network node i.e. eNB/RNC determines if it should request the logged measurements or not. If it decides to do so then a request is sent to the UE to deliver the

log in a report message. From the eNB/RNC, the reported logged measurements may further be sent to an OAM server or similar.

The current 3GPP assumptions on this log (i.e. logged measurements) feature are, e.g., as follows: the UE is required to maintain only one log at a time; one log only contains measurement information collected in one Radio Access Technology (RAT); a log can only be reported and indicated when the UE is in connected state; If UE is requested to start logging, e.g., by configuration, a possibly old log and configuration stored in UE is erased.

What the logged measurement report message in signal number 4 in Fig. 1 should look like has not yet been decided, as of the filing of this application. Some proposals for management of measurement report have been proffered.

As one example proposal for management of measurement reports, it has been suggested that a log i.e. logged measurements, are to be sent in a single packet, and keeping that single packet within the size limits of a Packet Data Convergence Protocol (PDCP) Protocol Data Unit (PDU). Keeping the single packet within the size limits of a PDCP PDU makes it possible to use a Radio Resource Control RRC message for reporting without being segmented into several smaller packets before being sent to the receiving node i.e., the eNB or NB/RNC in LTE or UMTS, respectively. One option of this proposal would be limiting the maximum size of a log in a UE to one RRC message that fits into one PDCP payload packet.

As another example proposal for management of measurement reports, it has been suggested to send a log i.e. a logged measurement that is larger than a RRC message with several RRC messages.

However, there are disadvantages to both example proposals mentioned above. For example, limiting the log size could prevent logging to complete for the whole configured run time i.e. logging duration, which can be several hours. The log could fill the limited log buffer in the UE before any measurement report has been possible to send to the network node. Before the configured logging duration time has ended, the UE would stop the logging so that to only allow the log size to be a single packet e.g. single RRC packet, and relevant measurements reports may not thereafter be logged. Also in the current MDT configuration a start time for the logging is not configurable. This means that for a prolonged logging campaign a long period between logging instances may be needed in the MDT configuration, alternatively new MDT

configuration needs to be provided from the OAM periodically to be conveyed to MDT capable UEs.

For the other proposal, sending too many RRC packets in a row could, in poor radio environments or when handover would occur, create problems with the radio connections and could also create unnecessary radio link failures that will make the users suffer and logged data be lost.

SUMMARY

The technology disclosed herein concerns network based control of report messages comprising logged measurements in a wireless communications network, which overcomes at least some of the above mentioned disadvantages and which allows multiple partial report messages to be sent.

In accordance with some example embodiments, a UE that has stored logged data i.e. logged measurements that are bigger than a single transmission packet, i.e. report message, segments the data and sends only a portion of the data that fits into a single report message, and also indicates that more logged measurements exists at the UE.

In a first example of embodiment, there is disclosed a method in a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The method comprises sending a request to the UE to start transmitting logged measurements in a report message. The network node then receives the report message comprising the logged measurements from the UE, and determines if the received report message comprises an indicator of additional logged measurements not yet transmitted, and if so, decides if the additional logged measurements need to be requested.

In a second example of an embodiment there is disclosed a network node for network based control of report messages in a wireless communications network. The network node being configured to serve a user equipment, UE, and to receive report messages from the user equipment. The network node comprises a network node communications interface and a network node processor circuit. The network node communications interface being configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements. The network node

processor circuit being configured to determine if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, to decide if the additional logged measurements need to be requested.

In a third example of an embodiment, there is disclosed a method in a User Equipment, UE, for assisting in network based control of report messages in a wireless communications network. The UE is being in connection with a serving network node and configured to transmit report messages to the network node upon request. The UE is further configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer as logged measurements. The method comprising: receiving a request, in the UE, from the network node to start transmitting logged measurements in a report message; determining if the logged measurements fit in the report message; and if not, including in the report message an indicator of additional logged measurements not yet transmitted; and, transmitting the report message, comprising the indicator, to the network node as a response to the request.

In a fourth example of an embodiment, there is disclosed a User Equipment, UE, for assisting in a network based control of report messages in a wireless communications network. The UE is being in connection with a serving network node and is configured to transmit report messages to the network node. The UE is further configured to periodically perform radio condition measurements and store the periodically performed measurements in a buffer as logged measurements. The UE comprises a UE communications interface and a UE processor circuit. The UE communications interface is configured to receive a request from the network node to start transmitting logged measurements in a report message, and to transmit the report message comprising the logged measurements. The UE processor circuit is configured to determine if the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

An advantage achieved by some of the above mentioned embodiments is that due to use of indicator in report message of further remaining logged measurements providing the network, i.e. a network node, with information needed to decide a timing of transmission of the logged measurements and a timing of when more logged measurements should be requested.

Another advantage achieved by at least some of the above mentioned embodiments is to make it possible to have longer logging duration and/or conduct more frequent measurements without overflow in log memory in UE e.g. UE buffer.

Another advantage achieved by some of the above mentioned embodiments is to provide the network node with information about logged measurements making it possible to determine the amount of logged measurements kept in a UE.

The foregoing and other objects, features, and advantages will become apparent from following more particular descriptions of preferred embodiments and aspects of embodiments as will be illustrated by accompanying drawings in which reference characters refer to the same parts throughout various views.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings are not necessarily to scale, emphasis instead being placed upon illustrating principles of the disclosure.

Fig. 1 is a signaling scheme illustrating how logged measurements are reported according to prior art.

Fig. 2 is a schematic block diagram illustrating example embodiments of a network node and a user equipment.

Fig. 3 is a flowchart depicting an example embodiment of a method in a network node.

Fig. 4 is a flowchart depicting further example embodiments of a method in a network node.

Fig. 5 is a flowchart depicting an example embodiment of a method in a user equipment.

Fig. 6 is a flowchart depicting further example embodiments of a method in a network node.

DETAILED DESCRIPTION

Fig. 2 illustrates portions of an example embodiment of a communications system/network, and particularly portions of a Radio Access Network (RAN) **20** comprising at least one network node **28** and a wireless terminal, hereinafter denoted User Equipment, (UE) **30**. Depending on a particular type of RAN utilized and delegation of nodal responsibilities, the

network node 28 may be a base station node e.g., an NodeB in UMTS or an eNodeB in Long Term Evolution (LTE)) or a Radio Network Controller (RNC) node in UMTS. Thus, the UE 30 communicates over radio interface **32** with the network node 28, either directly over radio interface 32 with the network node 28 in case of the network node 28 being a base station type node, or over the radio interface 32 and through a base station in the case of the network node 28 being a radio network controller (RNC) node or an Mobility Management Entity (MME) which is a control node which processes signaling between the UE and the Core Network (CN) and provides Visitor Location Register (VLR) functionality for the Evolved Packet System (EPS).

As mentioned above, the UE 30 can be a mobile station such as a mobile telephone ("cellular" telephone) or laptop with wireless capability (e.g., mobile termination), and thus can be, for example, a portable, pocket, hand-held, computer-included, or car-mounted mobile device which communicates voice and/or data via radio access network.

In accordance with one of its aspect, the technology disclosed concerns generation and/or transmission and/or use of multiple partial report messages with logged measurements such as MDT log packets, also denoted MDT log or MDT log data. As such, Fig. 2 shows an example embodiment of network node 28 or UE 30, which comprises a UE communication interface **42** and a UE processor circuit **40**. Note that the UE may be seen as a serving point. The UE processor circuit may include a buffer **44**, i.e. UE buffer, for storing logged measurements, not shown in figure, and in another embodiment the buffer 44 is within the UE 30.

Fig. 2 also illustrates network node 28 as comprising a network node processor circuit **50** and network node communications interface **52** (i.e. a communications interface of the network node). The network node processor circuit 50 may be, or comprise, a logged measurements requestor/processor (not shown in figure) to be used for requesting logged measurements, such as MDT log, in report message(s).

According to one example of an embodiment, the network node 28 is used for network based control of report messages comprising logged measurements in a wireless communications network, the network node 28 being configured to serve the UE 30, UE, and to receive report messages from the UE 30.

Continuing with the description of Fig. 2, the network node communications interface 52 is, or may be, configured to send request(s) to the UE 30 to start transmitting logged measurement(s) in report message(s), and to receive the report message(s) comprising the logged measurements. The logged measurements may comprise one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

According to one embodiment, the network node communications interface 52 may be configured to receive, from the UE 30, an indication of existents of logged measurements that are available. Note, that the "additional logged measurements" indicator is conveyed in the UE information report message while the indication of logged measurements available is conveyed in already existing/specified signaling.

According to one embodiment, the network node communications interface 52 may be configured to request the report message(s) directly from the UE 30 or from another network node, e.g. RNC, MME, RBS or other similar node.

According to one embodiment, the network node communications interface 52 may be configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node. The request may for example be a RRC connection request. The network node communications interface 52 may also be configured to receive a network node message from the other network node i.e. another eNodeB, RNC or RBS, comprising UE specific information. The UE specific information may further comprise the indicator indicating additional logged measurements not yet transmitted.

The network node processor circuit 50, mentioned above in relation to Fig.2, is configured to determine if the received report message(s) comprises an indicator of additional logged measurement(s) not yet transmitted; and if so, to decide if the additional logged measurements need to be requested. According to one embodiment, the network node processor circuit 50 may be configured to decide if the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc.

According to one embodiment, the network node processor circuit 50 may be configured to determine if the indicator indicates that there are logged measurements in a UE buffer 44 that do, or do not, fit in a single subsequent report message.

According to one embodiment, the network node processor circuit 50 may be configured to decide to request all the logged measurements in the buffer 44 of the UE in one subsequent request, or repeatedly upon receiving each report message. The decision may also be based on received status information of the buffer 44 in the UE 30 being for example overloaded. Note that configured to or adapted to in relation to functionality of circuits and devices mentioned above and throughout the whole disclosure are expressions that may be used having a similar or same meaning.

It should be appreciated that the network node processor circuit 50 may comprise an MDT log requestor/processor 50' (not shown in Fig. 2) which may be implemented in platform fashion, e.g., implemented by a computer/processor executing instructions of non-transient signals and/or by a circuit.

Likewise from a UE perspective, reference made to Fig. 2, the UE 30 may be, or is, used for assisting in network based control of report messages comprising logged measurements in a wireless communications network. The UE 30 is being in connection with the serving network node 28 and is configured to transmit report message(s) to the network node 30. The UE 30 may further be configured to periodically perform radio condition measurements and store the periodically performed measurements in the buffer 44 as logged measurements. Such logged measurements may be MDT log reports.

The UE communications interface 42 mentioned above in relation to Fig. 2, is configured to receive a request from the network node 28 to start transmitting logged measurements in report message(s), and to transmit/send the report message(s) comprising the logged measurements. The UE processor circuit 40 is configured to determine if the logged measurements fits in the report message(s), and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

According to one embodiment of an example implementation of a UE 30 in which the UE processor circuit 40 may be, or may comprise, a multiple partial MDT log reporter **40'** (Fig. 2 dashed lines). The multiple partial MDT log reporter 40' may comprise a log report generator

and data logging unit (not shown in Fig. 2). The multiple partial MDT log reporter 40' works in conjunction with a measurement unit (not shown in Fig. 2), and stores records of measurements in data logging unit. The log report generator may further comprise a packet identifier generator and "more data" i.e. additional data, flag generator.

The technology disclosed above, and in relation to some of the earlier mentioned embodiments, includes support for logged measurements, or an MDT log size, which exceeds a maximum size of the report message which may for example be a Packet Data Convergence Protocol (PDCP) packet. The technology disclosed herein also introduces and provides an indication from the UE 30 of additional logged measurements or MDT log data that remains in the UE buffer 44. In accordance with some example embodiments, a UE 30 that has stored logged measurements, sometimes denoted logged data, that are bigger than a single report message i.e. transmission packet, segments the logged measurements, and sends only a portion of the logged measurements that fits into a single report message. The UE 30 also indicates that more logged measurements exist at the UE 30 in the buffer 44. This indication of further remaining logged measurements allows the network node 28 to decide a timing of transmission of the logged measurements and a timing of when more logged measurements should be requested. This may for example depend on radio condition measurements or UE buffer status information.

The UE 30 will take a part of the logged measurements and put into the payload of the report message. The UE 30 will, if more logged measurements are still available, set a "more" or "additional" bit indicating to the network node 28, or by other means indicate to the network node 28, that there are more logged measurements available in the UE 30. The network node 28 will then, when it believes more data should be obtained e.g. based on: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc., request more logged measurements. When a request is done then the process may be repeated. A new decision may be taken after a new report message is received, and so on. In other words, upon reception of indication from UE, the network node 28 takes a decision (based on current radio conditions, node capacity) whether the network node 28 shall request more logged measurements "data" from the UE now or request it at a later point in time. This "later point in time" could be predefined e.g. 15s later. In one example an internal algorithm may for instance check to see if no Hand Over (HO) is imminent or other more vital procedure is at hand. The report messages

may be lost if unsuccessfully reporting happens just before a HO. In one example, the network node 28 may be configured to continue requesting reporting of logged measurements (MDT logs) in report messages until there are no more logged measurements to report.

An example of an embodiment of a method that may be implemented in the network node 28 is illustrated by **Fig. 3**. The method is used for network based control of report messages comprising logged measurements in a wireless communications network. According to the method, the network node 28 which is being configured to serve a UE 30, receives report messages from the UE 30 as mentioned above in relation to Fig. 2. More particularly, the method comprises: sending **S62** a request to the UE to start transmitting logged measurements in a report message; receiving **S64** the report message comprising the logged measurements; determining **S66** if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, deciding **S68** if the additional logged measurements need to be requested.

Yet an example of an embodiment of a method for implementation in the network node 28 is illustrated by **Fig. 4**. The general steps i.e. **S72, S74, S76** and **S78** correspond to S62-S68 mentioned above. In this example method comprises the network node 28 first receiving **S71**, e.g. from the UE 30, an indication of existents of logged measurements that are available i.e. the UE buffer 44 is not empty or more data exists in UE buffer 44. Note that this indication is different from the indicator indicating additional logged measurements.

According to the method, the network node 28 decides to send S72 request to the UE 30 to start reporting and receives S74 a report message as a response. The network node 28 then determines if the report message, which also comprises logged measurements and reporting time stamp, comprises an indicator of additional logged measurements not yet reported. If so, the network node 28 may decide S78 to request these additional logged measurements and therefore restarts at S72. If no indicator is included, the network node 28 will await **S77** a new indication S71, and restarts the procedure at S72. The network node 28 upon deciding S78 to request additional logged measurements may decide to request **S79** all logged measurements in one decision instead of requesting one subsequent report message at a time. In some example embodiments, if the UE 30 indicates that more than one reporting message is needed for the logged measurements in its UE buffer 44, several bits may then be used to indicate that. The

network node 28 may then choose to request multiple messages if the network node 28 so wants.

From a UE perspective, and an example of an embodiment which illustrates a method in a UE, reference is now made to **Fig. 5**. The UE 30 is configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer 44 as logged measurements. The method in the UE 30 for assisting in network based control of report messages comprising logged measurements in a wireless communications network, comprises: receiving **S82** a request from the network node 28 to start transmitting logged measurements in a report message; determining **S84** if the logged measurements fit in the report message; and if not, including **S86** in the report message an indicator of additional logged measurements not yet transmitted; and, transmitting **S88** the report message, comprising the indicator, to the network node 28 as a response to the request (S62; S72).

In an example of an embodiment and UE mode, the technology disclosed herein encompasses the following acts and capabilities, as illustrated by **Fig. 6**:

S90: UE periodically performs measurements and logs radio condition measurements, and possibly detailed positioning information of the UE 30, and stores the measurements as logged measurements in the UE buffer 44 i.e. in internal memory of the UE 30.

According to one embodiment the logged measurements in UE buffer 44 may be built up as "records" that include a "time stamp" indicating the time when the radio measurement was taken i.e. "measurement time stamp" and logged measurements. The record may optionally also include detailed position information of the UEs geographical position. The "records" may have variable size. The size of the logged measurements, sometimes denoted log size, in UE buffer 44 may be bigger than is possible to fit into one single report message to be sent from UE to network node.

S92: When the UE 30 receives a request from the network node 28 to start transmitting/reporting logged measurements, the UE 28 takes the number of "records" i.e. logged measurements, from the UE buffer 44 i.e. internal log, typically in the order of storage, that fits into the report message, and "advances" an internal pointer such that next-stored "records" will be included in the next report message next time the UE 30 is requested to report logged measurements.

This step, i.e. S92, may be preceded by that the UE 30 sending **S91** an indication to the network node 28 making it aware of logged measurements that are available at the UE 28.

S94: Upon receiving (S92) a request to start transmitting the UE 30 then determines if the logged measurements fit in a single report message or not.

If the logged measurements fit in one report message then no indicator is added or a dedicated bit for the indicator is left empty i.e. null is sent in that bit. Alternatively, an indication is added giving that no more information is available.

S96: In case the UE 30 has more logged measurements ("records") stored in the UE buffer 44 not yet reported an indicator of "additional logged measurements" i.e. more data exist is included in the report message.

A "Time stamp" value i.e. "Reporting time stamp" or other identifier is added to the report message at report message transmission. Alternatively, instead of including a reporting time stamp into the report message, a sequence number, stepped by one with each report message transmission may be used. Note that this reporting time stamp is different from the measurement time stamp added upon performing and logging the measurement.

S98: The UE 30 then transmits the report message, including oldest logged measurements obtained from UE buffer 44, to the network node 28 as a response to the request. The report message may therefore comprise logged measurements, a reporting time stamp and detailed positioning information of the UE 30.

S99: The UE 30 then deletes the transmitted/reported logged measurements from its buffer, i.e. UE buffer 44, and "advances" an internal pointer such that next-stored "records" will be included in the next report message. After receiving a new request from the network node 28 the UE 30 may then transmit/report logged measurements i.e. repeat steps S92-S99 and include new logged measurements i.e. "records", from the UE buffer 44, according to its internal pointer. Alternatively, or in combination with the reporting, the UE 30 may start again at step S90.

Note, that in current "MDT" general implementation the logging of measurements as logged measurements may only be done when UE is in "idle" state and the sending of logged

measurements (MDT logs) in report messages may only be done when the UE is in "connected" state.

In some example embodiments, if the UE buffer 44 is almost full or if a size limitation is to be reached, the UE 30 may indicate such conditions to the network node 28 during the sending S91 or adding that information during S96 and sending it during S98. The network node 28 may then prioritize the retrieval of logged measurements in order not to stop logging and/or loose logged measurements.

During the repeated sequence of messages between the UE 30 and the network node 28, to convey complete logged measurements from the UE 30 to the network node 28, there may be a need to change cell and/or serving Base Station (BS) e.g. during a handover form a first BS (eNB1; NB1; RNC1; RBS1) to a second BS (eNB1; NB1; RNC1; RBS1).

One way to handle cell change and/or BS change situations is that the UE indicate availability when it is connects to the second BS, e.g. according to S91 of Fig. 6. Thus the UE 30 being served by a first BS (e.g. eNB1) and which has for example sent two report messages to first BS, when performing a handover starts by sending an indication, i.e. sends S91 indication of logged measurements available, to second BS (e.g. eNB2) and then upon request starts reporting to second BS a third report message. Logged measurements that are sent in first and second report messages are generally deleted from UE buffer 44 and therefore not longer available.

A second way, or alternative, to handle this situation is that the information that the first BS (e.g. eNB1) has received with respect to "logged measurements available" as of step S91, is transferred to second BS (e.g. eNB2). The information is transferred based on a request from second BS or automatically, including any related information like trace references, etc. The idea here is to include the "indication" in already existing/specified handover preparation signaling (between eNB1 and eNB2) that is "preparing" the eNB2, before the UE is actually handed over (commanded) from eNB1 to eNB2.

In some situations, "trace references" and "logged measurements available" indication (S91) may be forwarded between RAN 20 nodes. In such cases, the UE 30 may also include the trace references in the report message when the UE 30 transmits a first report message to a RAN

node after handover. Note that this first report message, as of the example mentioned above in relation to the first way of handling the situation, would be the third report message.

Thus, the technology disclosed herein, in one of its aspects, supports and/or facilitates a log size exceeding a maximum size of a reporting message e.g. a PDCP packet. If the reporting loss/performance is considered an issue and needs to be addressed, while a restriction of a UEs total log size, in UE buffer or UE memory, is not wanted, then the UE that has stored logged measurements i.e. logged data, that is bigger than a single payload PDU (e.g due to PDCP restriction) may segment the logged measurements and send only a part that fits into a single report message/packet e.g., a message size in the UE response message has a fixed size while the MDT log itself has another limit e.g. UE buffer size restriction in UE 30 etc. To handle this, an indication in the report message e.g. the UE MDT log report, on that additional/more logged measurements exists is provided. This allows the network node 28 to decide the timing for when measurements should be requested and/or (re-)configured. Relying on the "report available bit" only would require that the UE again transients to RRC connected which may delay the transfer of logged measurements further, possibly involving UE log memory being exhausted, new logged MDT configuration or Hand Over (HO) to other Radio Access Technology (RAT) etc.

Thus, with a report message size restriction, the UE 30 shall be able to partition the logged measurements into a maximum fixed size reporting message e.g. an RRC message.

Currently the RRC message for MDT also carries information for RACH optimization (SON) and other optionally configured information. One consequence of the presence of other information in the RRC message/PDU using a size restriction would be that it possibly depends on the RRC message construction and configuration, or that the maximum size of a report message is always set according to a worst case scenario.

In view of the reasons above, no special handling of the RRC message/log size might be needed as a result of MDT. Retaining normal handling of RRC messages etc simplifies the considerations that need to taken in the network node 28 and UE 30.

The technology disclosed herein affords several advantages. Among the advantages are the following. The technology allows for long logging run times that may create large logged measurements sizes while the network node 28 controls the reporting time. The technology

facilitates that the network node 28 may determine an appropriate time of reporting without loosing logged measurements.

In the above description, for purposes of explanation and not limitation, specific details are set forth such as particular architectures, interfaces, techniques, etc. in order to provide a thorough understanding. However, it will be apparent to those skilled in the art that the above mentioned embodiments may be practiced in a ways that depart from these specific details. That is, those skilled in the art will be able to devise various arrangements which, although not explicitly described or shown herein, embody the principles of the embodiments and are included within their spirit and scope. In some instances, detailed descriptions of well-known devices, circuits, and methods are omitted so as not to obscure the description of the present embodiments with unnecessary detail. All statements herein reciting principles, aspects, and embodiments, as well as specific examples thereof, are intended to encompass both structural and functional equivalents thereof. Additionally, it is intended that such equivalents include both currently known equivalents as well as equivalents developed in the future, i.e., any elements developed that perform the same function, regardless of structure.

Thus, for example, it will be appreciated by those skilled in the art that block diagrams of Fig. 2 herein may represent conceptual views of illustrative circuitry or other functional units embodying the principles of the technology. Similarly, it will be appreciated that any flow charts as of Fig. 3- Fig. 6, state transition diagrams, pseudo code, and the like represent various processes which may be substantially represented in computer readable medium and so executed by a computer or processor, whether or not such computer or processor is explicitly shown.

Functions of various elements including functional blocks of Fig. 2, including but not limited to those labeled or described as "computer", "processor" or "controller", may be provided through the use of hardware such as circuit hardware and/or hardware capable of executing software in the form of coded instructions stored on computer readable medium. Thus, such functions and illustrated functional blocks are to be understood as being either hardware-implemented and/or computer-implemented, and thus machine-implemented.

In terms of hardware implementation, the functional blocks of network node 28 or UE 30 may include or encompass, without limitation, Digital Signal Processor (DSP) hardware, reduced instruction set processor, hardware (e.g., digital or analog) circuitry including but not limited to

Application Specific Integrated Circuit(s) [ASIC], and (where appropriate) state machines capable of performing such functions.

In terms of computer implementation, a computer is generally understood to comprise one or more processors or one or more controllers, and the terms computer and processor and controller may be employed interchangeably herein. When provided by a computer or processor or controller, the functions may be provided by a single dedicated computer or processor or controller, by a single shared computer or processor or controller, or by a plurality of individual computers or processors or controllers, some of which may be shared or distributed. Moreover, use of the term "processor" or "controller" shall also be construed to refer to other hardware capable of performing such functions and/or executing software, such as the example hardware recited above.

In the example of Fig. 5 the platform depicted by line 70 has been illustrated as computer-implemented or computer-based platform. Another example platform for wireless terminal 70(5) can be that of a hardware circuit, e.g., an application specific integrated circuit (ASIC) wherein circuit elements are structured and operated to perform the various acts described herein.

Although the description above contains many specificities, these should not be construed as limiting the scope of the invention but as merely providing illustrations of some of the presently preferred embodiments of this invention. It will be appreciated that the scope of the present invention fully encompasses other embodiments which may become obvious to those skilled in the art, and that the scope of the present invention is accordingly not to be limited. Reference to an element in the singular is not intended to mean "one and only one" unless explicitly so stated, but rather "one or more." All structural and functional equivalents to the elements of the above-described embodiments that are known to those of ordinary skill in the art are expressly incorporated herein by reference and are intended to be encompassed hereby. Moreover, it is not necessary for a device or method to address each and every problem sought to be solved by the present invention, for it to be encompassed hereby.

CLAIMS

1. Method in a network node for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the UE (30), the method comprising:

   - sending (S62) a request to the UE to start transmitting logged measurements in a report message;

   - receiving (S64) the report message comprising logged measurements;

   - determining (S66) if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so,

   - deciding (S68) if the additional logged measurements are to be requested.

2. The method according to claim 1, wherein the method comprises receiving (S71), from the UE, an indication of existents of logged measurements that are available.

3. The method according to any of claims 1 or 2, wherein the logged measurements comprises one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit power headroom conditions; paging channel failure(s); and broadcast channel failure(s).

4. The method according to any preceding claim, wherein the report message is received directly from the UE or via another network node.

5. The method according to any preceding claim, wherein the deciding (S68) is based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc.

6. The method according to any preceding claim, wherein the determining (S66) comprises determining if the indicator indicates that there is logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

7. The method according to claim 6, wherein the deciding (S68) comprises deciding (S79) to request all the logged measurements in the buffer of the UE in one subsequent request.

8. The method according to any preceding claim, wherein the method comprises receiving a previously sent report message from another network node(s), automatically or upon request.

9. The method according to any preceding claim, wherein the sending of a request is initiated by a UE handover procedure from another network node to the network node.

10. The method according to claim 9, wherein the method comprises receiving a network node message from the other network node comprising UE specific information.

11. The method according to claim 10, wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

12. A network node (28) for network based control of report messages in a wireless communications network, the network node (28) being configured to serve a user equipment (30), UE, and to receive report messages from the user equipment (30), the network node comprises:

- a network node communications interface (52) configured to send a request to the UE to start transmitting logged measurements in a report message, and to receive the report message comprising the logged measurements;

- a network node processor circuit (50) configured to determine if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, to decide if the additional logged measurements need to be requested.

13. The network node (28) according to claim 12, wherein the network node communications interface (52) is configured to receive, from the UE, an indication of an existents of logged measurements that are available.

14. The network node (28) according to any of claims 12 or 13, wherein the logged measurements comprises one or more of the following: measurement time stamps for each performed measurement; UE buffer state condition; positioning information of UE; periodically measured downlink pilot signal strength; serving cell conditions; transmit

power headroom conditions; paging channel failure(s); maximum required memory supported by UE; and broadcast channel failure(s).

15. The network node (28) according to any of claims 12 to 14, wherein the network node communications interface (52) is configured to request the report message directly from the UE or from another network node.

16. The network node (28) according to any of claims 12 to 15, wherein the network node processor circuit (50) is configured to decide if the additional logged measurements need to be requested based on one or more of the following: interference level experienced in a cell; radio condition measurements experienced in a cell; available radio resource; network node capacity; UE buffer state condition etc..

17. The network node (28) according to any of claims 12 to 16, wherein the network node processor circuit (50) is configured to the determine if the indicator indicates that there is logged measurements in a buffer of the UE that do, or do not, fit in a single subsequent report message.

18. The network node (28) according to claim 17, wherein the network node processor circuit (50) is configured to decide to request all the logged measurements in the buffer (44) of the UE in one subsequent request.

19. The network node (28) according to any of claims 12 to 18, wherein the network node communications interface (52) is configured to request the report message upon receiving a UE access request initiated by a UE handover procedure from another network node to the network node.

20. The network node (28) according to claim 19, wherein the network node communications interface (52) is configured to receive a network node message from the other network node comprising UE specific information.

21. The network node (28) according to claim 19 wherein the UE specific information comprises the indicator of additional logged measurements not yet transmitted.

22. Method in a User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a

serving network node (28) and configured to transmit report messages to the network node (30) upon request, and wherein the UE (30) is configured to periodically perform radio condition measurements and store the periodically performed measurements in a UE buffer (44) as logged measurements, the method comprising:

- receiving (S82) a request from the network node (28) to start transmitting logged measurements in a report message;
- determining (S84) if the logged measurements fit in the report message; and if not,
- including (S86) in the report message an indicator of additional logged measurements not yet transmitted; and,
- transmitting (S88) the report message, comprising the indicator, to the network node (28) as a response to the request.

23. The method according to claim 22, wherein the including comprises including a reporting time stamp in the report message.

24. The method according to any of claims 22 or 23, wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

25. The method according to any of claims 22 to 24, wherein the logged measurements that are oldest in the buffer are reported first.

26. A User Equipment (30), UE, for assisting in network based control of report messages in a wireless communications network, the UE (30) being in connection with a serving network node (28) and configured to transmit report messages to the network node (30), and wherein the UE (30) is configured to periodically perform radio condition measurements and store the periodically performed measurements in a buffer as logged measurements, the UE (30) comprises:

- a UE communications interface (42) configured to receive a request from the network node (28) to start transmitting logged measurements in a report message, and to transmit the report message comprising the logged measurements;

- a UE processor circuit (40) configured to determine if the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

27. The User Equipment (30) according to claim 26, wherein the UE processor circuit (40) is configured to add a reporting time stamp to the reporting message.

28. The User Equipment (30) according to any of claims 26 or 27 wherein the logged measurements that are transmitted to the network node are further deleted from the buffer of the UE.

29. The User Equipment (30) according to any of claims 26 to 28, wherein the logged measurements that are oldest in the buffer are transmitted first.

30. The User equipment (30) according to any of claims 26 to 29, wherein the logged measurements are Minimizing Drive Tests, MDT, log data.

ABSTRACT

This disclosure pertains to a method in a network node, a method in user equipment, a network node and user equipment in a wireless communications network. More particularly, there is provided methods and platforms for network based control of report messages comprising logged measurements in a wireless communications network. In accordance with some example embodiments, a UE (30) that has stored logged data i.e. logged measurements that are bigger than a single transmission packet, i.e. report message, segments the logged measurements and sends only a portion of the logged measurements that fits into a single report message. The UE (30) also indicates to a network node (28) that additional logged measurements exist at the UE buffer (44).

(For publication Fig. 3)

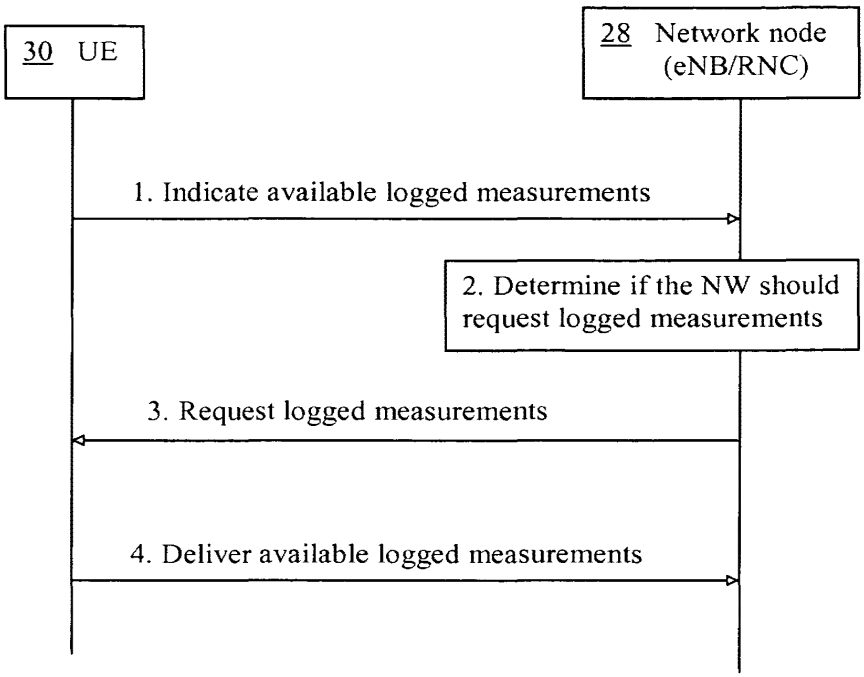

Fig. 1 (Prior art)

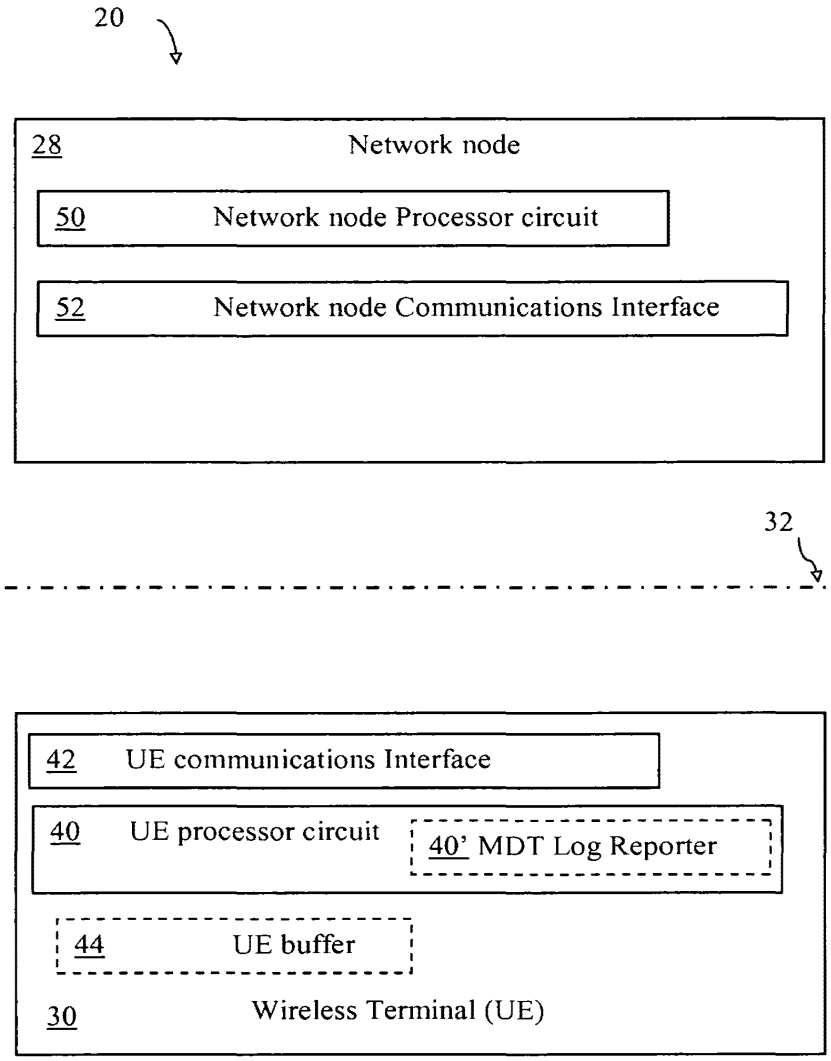
20
28
Network node
50
Network node Processor circuit
52
Network node Communications Interface
32
42
UE communications Interface
40
UE processor circuit
40' MDT Log Reporter
44
UE buffer
30
Wireless Terminal (UE)

Fig. 2

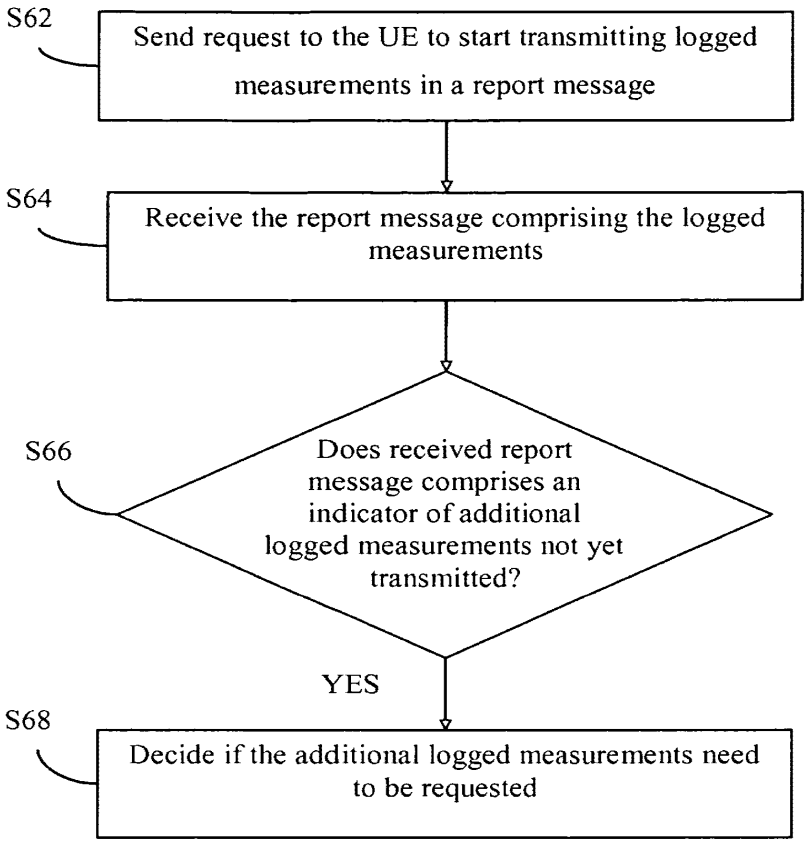
S62
Send request to the UE to start transmitting logged measurements in a report message
S64
Receive the report message comprising the logged measurements
S66
Does received report message comprises an indicator of additional logged measurements not yet transmitted?
YES
S68
Decide if the additional logged measurements need to be requested

Fig. 3

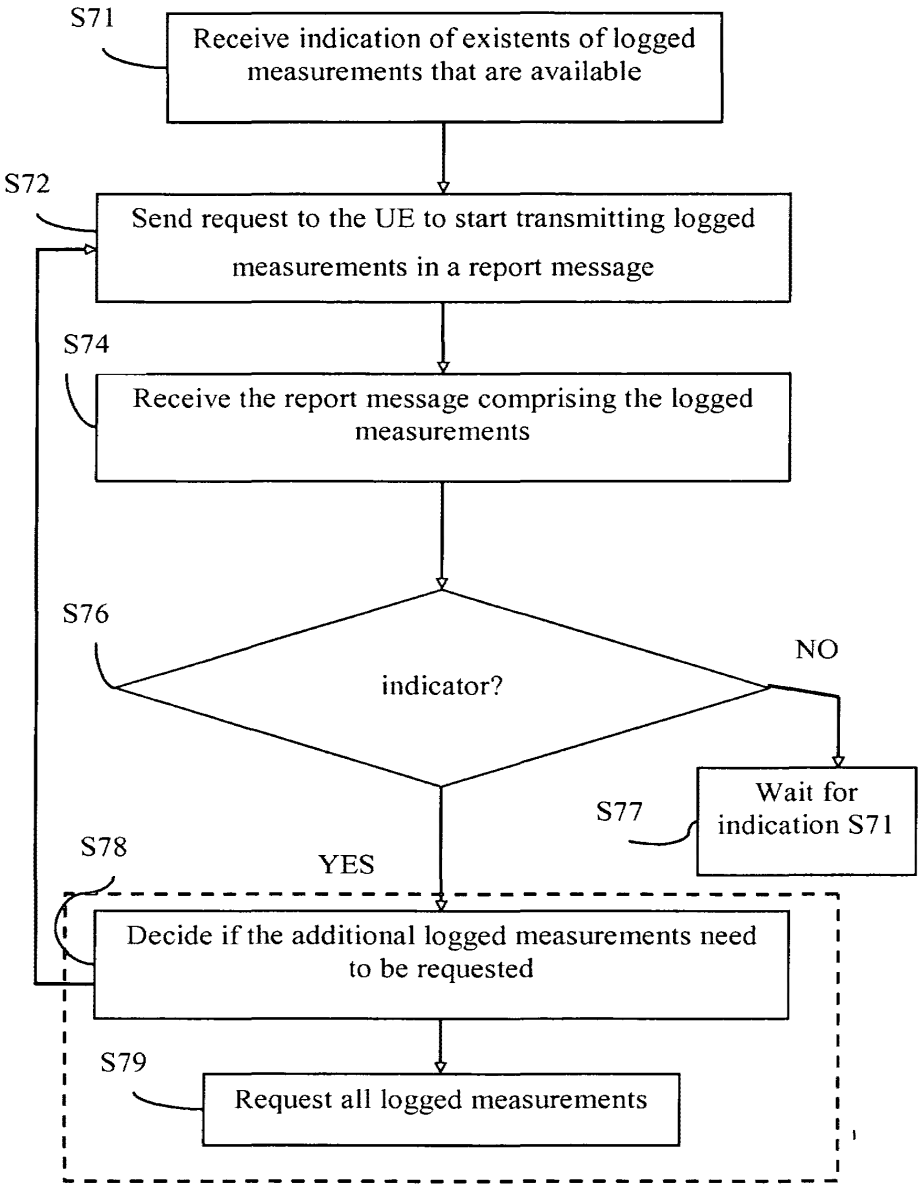
S71
Receive indication of existents of logged measurements that are available
S72
Send request to the UE to start transmitting logged measurements in a report message
S74
Receive the report message comprising the logged measurements
S76
indicator?
NO
S77
Wait for indication S71
S78
YES
Decide if the additional logged measurements need to be requested
S79
Request all logged measurements

Fig. 4

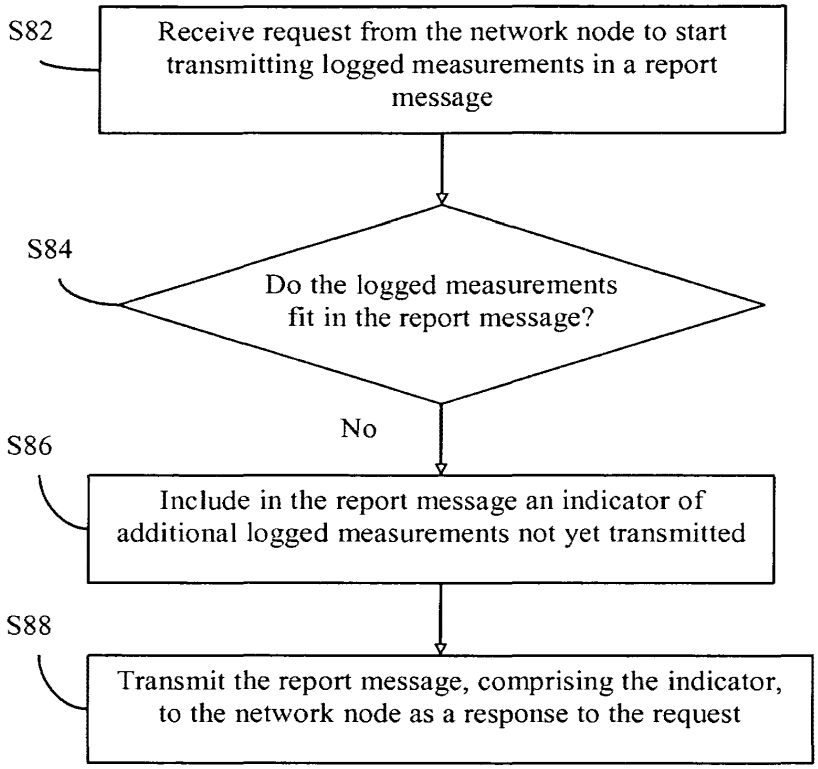
S82
Receive request from the network node to start transmitting logged measurements in a report message
S84
Do the logged measurements fit in the report message?
No
S86
Include in the report message an indicator of additional logged measurements not yet transmitted
S88
Transmit the report message, comprising the indicator, to the network node as a response to the request

Fig. 5

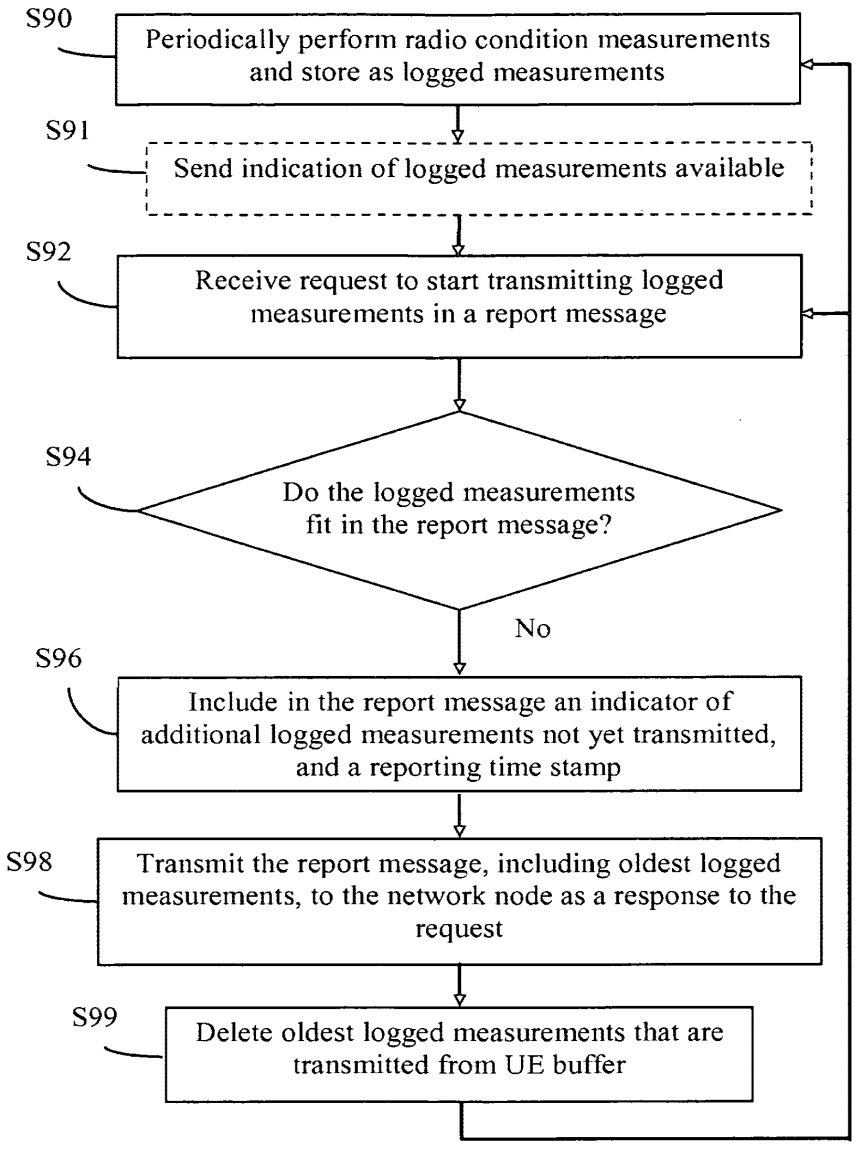
S90
Periodically perform radio condition measurements and store as logged measurements
S91
Send indication of logged measurements available
S92
Receive request to start transmitting logged measurements in a report message
S94
Do the logged measurements fit in the report message?
No
S96
Include in the report message an indicator of additional logged measurements not yet transmitted, and a reporting time stamp
S98
Transmit the report message, including oldest logged measurements, to the network node as a response to the request
S99
Delete oldest logged measurements that are transmitted from UE buffer

Fig. 6

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 2380-1599
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371	APPLICATION NO. (if known, see 37 C.F.R. 1.5) 13/001,687

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/SE2010/051355	9 December 2010	4 October 2010

TITLE OF INVENTION

MINIMIZING DRIVE TEST LOGGED DATA REPORTING

APPLICANT(S) FOR DO/EO/US

PERSSON et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☐ This is a **FIRST** submission of items concerning a submission under 35 U.S.C. 371.
2. ☒ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a submission under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The U.S. has been elected (Article 31).
5. A copy of the International Application as filed (35 U.S.C. 371(c)(2).
   a. ☐ is attached hereto (pages specification, claims & abstract (claims), sheets drawings).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(3))
   a. ☐ is attached hereto (pages specification, claims & abstract (claims), sheets drawings, page Certificate of Translation).
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has **NOT** expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3).
9. a. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4).
   b. ☐ Declaration was submitted to the International Bureau during International Phase (see copies of Declaration (page Form PCT/RO/101 and Form PCT/IB/371 and first page of printed publication acknowledging receipt thereof attached).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5).

Items 11 To 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included.
13. a. ☐ A FIRST preliminary amendment.
    b. ☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ An Application Data Sheet under 37 C.F.R. § 1.76.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 37 CFR 1.821-1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☐ Other items or information.

Mail Stop PCT

U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
13/001,687	**PCT/SE2010/051355**	**2380-1599**

☒ The following fees are submitted:

BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5):			
21. ☐ Basic national fee	$380.00 (1631)/$190.00 (2631)	$	
22. ☐ Examination Fee	$0.00 (1643/2643)		
	$250.00 (1633)/$125.00 (2633)	$	
23. ☐ Search Fee	$0.00 (1640/2640)		
	$120.00 (1641)/$60.00 (2641)		
	$490.00 (1642)/$245.00205 (2642)		
	$620.00 (1632)/$310.00 (2632)	$	
TOTAL OF ABOVE CALCULATIONS		$	0.00

☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing or computer program listing filed in an electronic medium). The fee is $310.00 for each additional 50 sheets of paper or fraction thereof.

Total Sheets	Extra Sheets		Number of each additional 50 or fraction thereof (round up to a whole number		RATE		
40 -100	0	/50 =	0.00		**$0.00** (1681) **$0.00** (2681)	$	

Surcharge of **$130.00** (1617)/**$65.00** (2617) for furnishing the oath or declaration later than ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)). $

CLAIMS	NUMBER FILED		# EXTRA	RATE			
Total Claims	30	minus 30 =	0 X	$60.00 (1615)/	$30.00 (2615)	$	
Independent Claims	4	minus 4 =	0 X	$250.00 (1614)	$125.00 (2614)	$	
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)				$450.00 (1616)/$225.00 (2616)		$	0.00

Petition is hereby made to extend the current due date so as to cover the filing date of this paper and attachment(s): One Month Extension $150.00 (1251)/$75.00 (2251); Two Month Extension $560.00 (1252)/$280.00 (2252);Three Month Extension $1270.00 (1253/$635.00 (2253); Four Month Extension $1980.00 (1254/$990.00 (2254); Five Month Extensions $2690.00 (1255/$1345.00 (2255)	$	0.00
☐ Applicant claims small entity status. See 37 CFR 1.27.		
Processing fee of **$130.00** (1618), for furnishing the English Translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 C.F.R. 1.492(f). +		0.00
TOTAL NATIONAL FEE =	$	**0.00**
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). **$40.00** (8021) per property +	$	40.00
Fee for Petition to Revive Unintentionally Abandoned Application;**$1860.00** (1453) / **$930.00** (2453)	$	0.00
TOTAL FEES ENCLOSED =	$	**40.00**
	Amount to be: refunded:	$
U.S. Application No.13/001,687; Atty Docket No.2380-1599	Amount to be Charged:	$

a. ☐ A check in the amount of $40.00 to cover the above fees is enclosed.
b. ☐ Please charge my Deposit Account No. 14-1140 in the amount of $_____ to cover the above fees.
c. ☒ The Commissioner is hereby authorized to charge any deficiency, or credit any overpayment, in the fee(s) filed, or asserted to be filed, or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Account No. 14-1140. **However, authorization is NOT given hereby to charge any extra claims fee or multiple dependent claims fees.**
d. ☒ **CREDIT CARD PAYMENT (FORM ATTACHED IF PAPER FILING).**
e. ☒ The entire content of International Application No. **PCT/SE2010/051355** and any U.S. and foreign application(s) corresponding thereto, and , referred to in this application is/are hereby incorporated by reference in this application.

NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b) must be filed and granted to restore the application to pending status.

CORRESPONDENCE ADDRESS
Direct all correspondence to:

☒ **Customer Number:** **23117**
Type Customer Number here

Telephone: (703) 816-4000
HWB:lsh

H Warren Burnam Jr.

H. Warren Burnam, Jr.
NAME

29,366 **October 14, 2011**
REGISTRATION NUMBER Date

1883902

RULE 63 (37 C.F.R. 1.63)
INVENTORS DECLARATION FOR PATENT APPLICATION
IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

As a below named inventor, I hereby declare that my residence, mailing address and citizenship are as stated below next to my name, and I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

MINIMIZING DRIVE TEST LOGGED DATA REPORTING

the specification of which (check applicable box(es)):

[ ] is attached hereto

[X] was filed on December 28, 2010 as U.S. Application Serial No. **13/001,687** (Atty. Dkt. No. HWB-2380-1599)

[X] was filed as PCT International application No. PCT/SE2010/051355 on 9 December 2010

and (if applicable to U.S. or PCT application) was amended on December 28, 2010

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above. I acknowledge the duty to disclose to the Patent Office all information known to me to be material to patentability as defined in 37 C.F.R. 1.56. I hereby claim foreign priority benefits under 35 U.S.C. 119/365 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed or, if no priority is claimed, before the filing date of this application:

Priority Foreign Application(s):

Application Number	Country	Day/Month/Year Filed

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

Application Number	Day/Month/Year Filed

I hereby claim the benefit under 35 U.S.C. 120/365 of all prior United States and PCT international applications listed above or below:

Prior U.S./PCT Application(s): Application Serial No.	Day/Month/Year Filed	Status: patented pending, abandoned
PCT/SE2010/051355	9 December 2010	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon. And on behalf of the owner(s) hereof, I hereby appoint Nixon & Vanderhye P.C., telephone number 703-816-4000 (to whom all communications are to be directed) and the attorneys of: **Customer Number 23117**, individually and collectively owner's/owners' attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith and with the resulting patent. I also authorize Nixon & Vanderhye to add or delete attorneys from that Customer Number, and to act and rely solely on instructions directly communicated from the person, assignee, attorney, firm, or other organization sending instructions to Nixon & Vanderhye on behalf of the owner(s).

1. Inventor's Signature: Håkan Persson Date: 2011-01-03

1. Inventor: Håkan (first) MI PERSSON (last) Sweden (citizenship)
Residence: (city) Solna (state/country) Sweden
Mailing Address: Huvudstagatan 13, Solna, SE
(Zip Code) SE-171 58

2. Inventor's Signature: Henrik Enbuske Date: 2011-01-03

2. Inventor: Henrik (first) MI ENBUSKE (last) Sweden (citizenship)
Residence: (city) Stockholm (state/country) Sweden
Mailing Address: Norrbackagatan 4, 3tr., Stockholm, SE
(Zip Code) SE-113 41

[X] ***See attached sheet(s) for additional inventor(s) information.***

1736690

3. Inventor's Signature: Håkan Palm Date: 13 Jan 2011

3. Inventor: Håkan (first) MI PALM (last) Sweden (citizenship)

Residence: (city) Växjo (state/country) Sweden

Mailing Address: Borggårdsvägen 167, Växjo, SE

(Zip Code) SE-352 61

1736690

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13001687
	Filing Date	2010-12-09
	First Named Inventor	PERSSON Hakan
	Art Unit	
	Examiner Name	
	Attorney Docket Number	2380-1599

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13001687
	Filing Date	2010-12-09
	First Named Inventor	PERSSON Hakan
	Art Unit	
	Examiner Name	
	Attorney Docket Number	2380-1599

	1	3GPP TS 37.320, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Measurement Collection for Minimization of Drive Tests (MDT); Overall Description; Stage 2 (Release 10), V10.0.0, 2010-12	☐
	2	3GPP TR 36.805, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on Minimization of Drive-Tests in Next Generation Networks (Release 9), V9.0.0, 2009-12	☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13001687
	Filing Date	2010-12-09
	First Named Inventor	PERSSON Hakan
	Art Unit	
	Examiner Name	
	Attorney Docket Number	2380-1599

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H. Warren Burnam, Jr./	Date (YYYY-MM-DD)	2011-10-25
Name/Print	H. Warren Burnam, Jr.	Registration Number	29,366

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt	
EFS ID:	11257236
Application Number:	13001687
International Application Number:	
Confirmation Number:	3427
Title of Invention:	MINIMIZING DRIVE TEST LOGGED DATA REPORTING
First Named Inventor/Applicant Name:	Hakan PERSSON
Customer Number:	23117
Filer:	H. Warren Burnam
Filer Authorized By:	
Attorney Docket Number:	2380-1599
Receipt Date:	25-OCT-2011
Filing Date:	
Time Stamp:	13:26:04
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	2380-1599-IDS-Oct_25_11.pdf	783769 f6fbcc18d11e43109f787301fbd48dbdb94e51ce	no	4
Warnings:					
Information:					

A U.S. Patent Number Citation or a U.S. Publication Number Citation is required in the Information Disclosure Statement (IDS) form for autoloading of data into USPTO systems. You may remove the form to add the required data in order to correct the Informational Message if you are citing U.S. References. If you chose not to include U.S. References, the image of the form will be processed and be made available within the Image File Wrapper (IFW) system. However, no data will be extracted from this form. Any additional data such as Foreign Patent Documents or Non Patent Literature will be manually reviewed and keyed into USPTO systems.

2	Non Patent Literature	2380-1599-3GPP-TS-37_320.pdf	276921 5afa15754813b82042b0485f59523f9ec43f61ac	no	17
Warnings:					
Information:					
3	Non Patent Literature	2380-1599-3GPP-TR_36_805.pdf	350692 e387002c8b0522160d992bd067be6d53434c5d79	no	24
Warnings:					
Information:					
		Total Files Size (in bytes):	1411382		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/001,687	10/14/2011		1850	2380-1599	30	4

CONFIRMATION NO. 3427

23117
NIXON & VANDERHYE, PC
901 NORTH GLEBE ROAD, 11TH FLOOR
ARLINGTON, VA 22203

FILING RECEIPT

Date Mailed: 04/17/2013

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Håkan Persson, Solna, SWEDEN;
Henrik Enbuske, Stockholm, SWEDEN;
Håkan Palm, Vaxjo, SWEDEN;

Applicant(s)

Håkan Persson, Solna, SWEDEN;
Henrik Enbuske, Stockholm, SWEDEN;
Håkan Palm, Vaxjo, SWEDEN;

Power of Attorney: The patent practitioners associated with Customer Number 23117

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/SE10/51355 12/09/2010
which claims benefit of 61/389,581 10/04/2010

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 04/12/2013
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/001,687**
Projected Publication Date: 07/25/2013
Non-Publication Request: No
Early Publication Request: No

Title

MINIMIZING DRIVE TEST LOGGED DATA REPORTING

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where

the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/001,687

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	480
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	30 minus 20 =	* 10			OR	x 80 =	800
INDEPENDENT CLAIMS (37 CFR 1.16(h))	4 minus 3 =	* 1				x 420 =	420
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	2700

APPLICATION AS AMENDED - PART II

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
13/001,687	Håkan Persson	2380-1599

23117
NIXON & VANDERHYE, PC
901 NORTH GLEBE ROAD, 11TH FLOOR
ARLINGTON, VA 22203

INTERNATIONAL APPLICATION NO.	
PCT/SE10/51355	
I.A. FILING DATE	PRIORITY DATE
12/09/2010	10/04/2010

CONFIRMATION NO. 3427
371 ACCEPTANCE LETTER

OC000000060422720

Date Mailed: 04/17/2013

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as a Designated / Elected Office (37 CFR 1.495), has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is ACCEPTED for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

10/14/2011	04/04/2013
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF COMPLETION OF ALL 35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE " FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1), (c)(2) and (c)(4) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).* Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

The following items have been received:

- Copy of the International Application filed on 12/28/2010
- English Translation of the IA filed on 12/28/2010
- Copy of the International Search Report filed on 12/28/2010
- Copy of IPE Report filed on 12/28/2010
- Copy of Annexes to the IPER filed on 12/28/2010
- Preliminary Amendments filed on 12/28/2010
- Information Disclosure Statements filed on 10/25/2011
- Oath or Declaration filed on 10/14/2011
- U.S. Basic National Fees filed on 12/28/2010
- Assignment filed on 10/14/2011
- Priority Documents filed on 12/28/2010

FORM PCT/DO/EO/903 (371 Acceptance Notice)

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

PATRICIA A BOOKER

Telephone: (571) 272-3882

FORM PCT/DO/EO/903 (371 Acceptance Notice)

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/001,687	10/14/2011	H?kan Persson	2380-1599

CONFIRMATION NO. 3427

23117
NIXON & VANDERHYE, PC
901 NORTH GLEBE ROAD, 11TH FLOOR
ARLINGTON, VA 22203

PUBLICATION NOTICE

OC000000062814174

Title:MINIMIZING DRIVE TEST LOGGED DATA REPORTING

Publication No.US-2013-0190031-A1
Publication Date:07/25/2013

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Reference Page

PTO/SB/80 (11-08)
Approved for use through 11/30/2011. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(b).

I hereby appoint:

☑ Practitioners associated with the Customer Number: 05073

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

as attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(b).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(b) to:

☑ The address associated with Customer Number: 05073

OR

☐ Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address:

Telefonaktiebolaget L M Ericsson (publ)
SE-164 83 Stockholm
Sweden

A copy of this form, together with a statement under 37 CFR 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	Lena Lundholm Carlson 2014-03-04
Name	Lena Lundholm Carlson Telephone +46 10 7190000
Title	Vice President Patentdevelopment IPR Manager and PO

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/SB/96 (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(b)

Applicant/Patent Owner: Håkan Persson et al.

Application No./Patent No.: 13/001,687 Filed/Issue Date: 2011-10-14

Titled: MINIMIZING DRIVE TEST LOGGED DATA REPORTING

Telefonaktiebolaget L M Ericsson (PUBL), a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.

states that it is:

1. ☒ the assignee of the entire right, title, and interest in;

2. ☐ an assignee of less than the entire right, title, and interest in
(The extent (by percentage) of its ownership interest is _____ %); or

3. ☐ the assignee of an undivided interest in the entirety of (a complete assignment from one of the joint inventors was made)

the patent application/patent identified above, by virtue of either:

A. ☒ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 027192, Frame 0018, or for which a copy therefore is attached.

OR

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

2. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

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Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☒ As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (*i.e.*, a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

Signature	March 18, 2014 Date
Chad C. Walters Printed or Typed Name	Attorney of Record Title

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	18510587
Application Number:	13001687
International Application Number:	
Confirmation Number:	3427
Title of Invention:	MINIMIZING DRIVE TEST LOGGED DATA REPORTING
First Named Inventor/Applicant Name:	Håkan Persson
Customer Number:	23117
Filer:	Chad Christian Walters/Wendy Flottman
Filer Authorized By:	Chad Christian Walters
Attorney Docket Number:	2380-1599
Receipt Date:	18-MAR-2014
Filing Date:	14-OCT-2011
Time Stamp:	15:44:58
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Power of Attorney	EricssonPOA.PDF	104812 aa1dc2c9975eff1dc92ad6de911d3aaf84a1909a	no	1
Warnings:					
Information:					

2	Assignee showing of ownership per 37 CFR 3.73.	stmt0227.PDF	163236 a49cf7569dfb39ae76ff8738169589899cc684ff	no	2

Warnings:	
Information:	
Total Files Size (in bytes):	268048

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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NOTICE OF ALLOWANCE AND FEE(S) DUE

5073 7590 03/24/2014

BAKER BOTTS L.L.P.
2001 ROSS AVENUE
SUITE 600
DALLAS, TX 75201-2980

EXAMINER	
FERGUSON, KEITH	
ART UNIT	PAPER NUMBER
2648	

DATE MAILED: 03/24/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/001,687	10/14/2011	Håkan Persson	2380-1599	3427

TITLE OF INVENTION: MINIMIZING DRIVE TEST LOGGED DATA REPORTING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	06/24/2014

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

5073 7590 03/24/2014
BAKER BOTTS L.L.P.
2001 ROSS AVENUE
SUITE 600
DALLAS, TX 75201-2980

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/001,687	10/14/2011	Håkan Persson	2380-1599	3427

TITLE OF INVENTION: MINIMIZING DRIVE TEST LOGGED DATA REPORTING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	06/24/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
FERGUSON, KEITH	2648	455-517000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/001,687	10/14/2011	Håkan Persson	2380-1599	3427

5073 7590 03/24/2014

BAKER BOTTS L.L.P.
2001 ROSS AVENUE
SUITE 600
DALLAS, TX 75201-2980

EXAMINER	
FERGUSON, KEITH	
ART UNIT	PAPER NUMBER
2648	

DATE MAILED: 03/24/2014

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 0 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 0 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 13/001,687	Applicant(s) PERSSON ET AL.	
	Examiner KEITH FERGUSON	Art Unit 2648	AIA (First Inventor to File) Status No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *12/28/2010*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *1-30*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   Certified copies:
   a) ☐ All b) ☐ Some *c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 10/25/2011
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

1. The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Allowable Subject Matter

2. Claims 1-30 are allowed.

3. The following is an examiner's statement of reasons for allowance: Regarding claim 1, the prior art of record fails to teach or suggest alone, or in combination determining if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, deciding if the additional logged measurements are to be requested.

Regarding claim 12, the prior art of record fails to teach or suggest alone, or in combination a network node processor circuit configured to determine if the received report message comprises an indicator of additional logged measurements not yet transmitted; and if so, to decide if the additional logged measurements need to be requested.

Regarding claim 22, the prior art of record fails to teach or suggest alone, or in combination determining if the logged measurements fit in the report message; and if not, including in the report message an indicator of additional logged measurements not yet transmitted; and, transmitting the report message, comprising the indicator, to the network node as a response to the request.

Regarding claim 26, the prior art of record fails to teach or suggest alone, or in combination a UE processor circuit configured to determine if the logged measurements fits in the report message, and if not, indicating in the report message to be transmitted an existents of additional logged measurements not yet transmitted.

Zhou et al. (U.S. Pub. No. 2011/0276838) discloses a method in a network node for network based control of report messages in a wireless communications network (fig. 2 and P:0039-P:0043) , the network node being configured to serve a user equipment UE (fig. 2) , and to receive report messages from the UE (fig. 2 number 202 and 206), the method comprising: sending a request to the UE to start transmitting logged measurements in a report message (fig. 2 number 208); receiving the report message comprising logged measurements (fig. 2 number 210, P:0032,P:0034, P:0029-P:0042 and P:0053-P:0054).

However, Zhou et al. nor the prior art of record teaches applicant's claimed invention with the allowable subject matter discussed above.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably

accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KEITH FERGUSON whose telephone number is (571)272-7865. The examiner can normally be reached on 7:am-4:pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Maung Nay can be reached on (571) 272-7882. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/KEITH FERGUSON/
Primary Examiner, Art Unit 2648
March 18, 2014

Notice of References Cited	Application/Control No. 13/001,687	Applicant(s)/Patent Under Reexamination PERSSON ET AL.	
	Examiner KEITH FERGUSON	Art Unit 2648	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2011/0276838	11-2011	Zhou et al.	714/45
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Issue Classification	**Application/Control No.** 13001687	**Applicant(s)/Patent Under Reexamination** PERSSON ET AL.
	Examiner KEITH FERGUSON	**Art Unit** 2648

CPC

Symbol					Type	Version
H04W		24	/	10	F	20130101
G06F		11	/	34	I	20130101
H04B		7	/	00	A	20130101
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CPC Combination Sets

Symbol					Type	Set	Ranking	Version
			/					
			/					

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 30	
/KEITH FERGUSON/ Primary Examiner.Art Unit 2648 (Primary Examiner)	3/19/2014 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 3

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13001687	PERSSON ET AL.
	Examiner	**Art Unit**
	KEITH FERGUSON	2648

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION									
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED				
455	517	H	0	4	B	7 / 00 (2006.01.01)					

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
455	500	423	67.11	425	426.1
370	241	252	310	328	343
714	45	25	1		

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	30	
/KEITH FERGUSON/ Primary Examiner.Art Unit 2648	3/19/2014	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	1	3

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13001687	PERSSON ET AL.
	Examiner	**Art Unit**
	KEITH FERGUSON	2648

☒ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1		17												
	2		18												
	3		19												
	4		20												
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	13		29												
	14		30												
	15														
	16														

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 30	
/KEITH FERGUSON/ Primary Examiner.Art Unit 2648 (Primary Examiner)	3/19/2014 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 3

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United States Patent and Trademark Office
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BIB DATA SHEET

CONFIRMATION NO. 3427

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/001,687	10/14/2011 RULE	455	2648	2380-1599

APPLICANTS

INVENTORS

Håkan Persson, Solna, SWEDEN;
Henrik Enbuske, Stockholm, SWEDEN;
Håkan Palm, Vaxjo, SWEDEN;

**** CONTINUING DATA ***************************

This application is a 371 of PCT/SE10/51355 12/09/2010
which claims benefit of 61/389,581 10/04/2010

**** FOREIGN APPLICATIONS ***************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****

04/12/2013

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ Yes ☑ No	☐ Yes ☑ No	/KEITH FERGUSON/ Examiner's Signature	☐ KF Initials	SWEDEN	6	30	4

ADDRESS

NIXON & VANDERHYE, PC
901 NORTH GLEBE ROAD, 11TH FLOOR
ARLINGTON, VA 22203
UNITED STATES

TITLE

MINIMIZING DRIVE TEST LOGGED DATA REPORTING

FILING FEE RECEIVED		
1850	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	82168	log$3 near3 (report or message or proceed$3 or account$3 or summarat$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 08:51
S2	5296029	(mobile or wireless or cellular or radio)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 08:55
S3	50026	S1 and S2	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 08:56
S4	967	request$3 near2 (start$3 or send$3 or transmit$4 or deliver$3) near4 log$3 near3 (report or message or proceed$3 or account$3 or summarat$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 08:57
S5	540	S3 and S4	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 08:57
S6	276524	log$3 near4 (measure$4 or diagnostic$4 or test$3 or comput$4 or calculat$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 08:59
S7	152	S5 and S6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 08:59
S8	112042	log$3 near3 (report or message or proceed$3 or account$3 or summarat$3 or record)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 09:00
S9	29538	S6 and S8	US-PGPUB; USPAT;	OR	ON	2014/03/14 09:01

			USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB			
S10	1047	request$3 near2 (start$3 or send$3 or transmit$4 or deliver$3) near4 log$3 near3 (report or message or proceed$3 or account$3 or summarat$3 or record)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 09:01
S11	251	S9 and S10	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 09:01
S12	172	S2 and S11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 09:02
S13	13531	(addition$3 or more or on adj1 way) near4 log$3 near4 (measure$4 or diagnostic$4 or test$3 or comput$4 or calculat$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 09:04
S14	21	S12 and S13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 09:04
S15	395	request$3 near4 (start$3 or send$3 or transmit$4 or deliver$3) near4 (log or logged) near1 (report or message or proceed$3 or account$3 or summarat$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 09:15
S16	458	request$3 near4 (start$3 or send$3 or transmit$4 or deliver$3) near4 (log or logged) near1 (report or message or proceed$3 or account$3 or summarat$3 or record)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 09:16
S17	258	S2 and S16	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 09:16
S18	95	S6 and S17	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/14 09:16
S19	0	("2013/0010631").URPN.	USPAT	OR	ON	2014/03/14 09:19

S20	3	("20090257353" | "20100190488" | "20110276838").PN. OR ("8571542").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2014/03/14 09:32
S21	1	("2011/0276838").URPN.	USPAT	OR	ON	2014/03/14 09:36
S22	6	("20050042987" | "20090036116" | "20100273472" | "20100291939" | "20110286356" | "20110292852").PN. OR ("8467781").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2014/03/14 09:37

3/19/2014 9:27:38 AM
C:\Users\kferguson\Documents\EAST\Workspaces\13001687.wsp

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3130	(addition$3 or more or on adj1 way) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/19 09:14
L2	2002	(mobile or wireless or cellular or radio) and L1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/19 09:14
L3	599	(addition$3 or more or on adj1 way) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record) same indicat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/19 09:14
L4	381	L2 and L3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/19 09:14
L5	37	4 AND ((G06F17/30368 OR G06F11/0778 OR G06F11/0766 OR H04W24/10 OR H04W24/08 OR H04W88/02).CPC. OR (714/E11.025 OR 714/45 OR 455/517 OR 455/67.11 OR 370/241 OR 370/328 OR 370/329).CCLS. AND (H04L12/26 OR H04W24/10).IPCR.)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/19 09:23
S1	67	request$3 near4 (start$3 or send$3 or transmit$4 or deliver$3) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record) and (addition$3 or more or on adj1 way) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:26
S2	49	(mobile or wireless or cellular or radio) and S1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:27

S3	3130	(addition$3 or more or on adj1 way) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:34
S4	2002	(mobile or wireless or cellular or radio) and S3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:34
S5	599	(addition$3 or more or on adj1 way) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record) same indicat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:35
S6	381	S4 and S5	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:36
S7	142	(logged or log).ab. and S6	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:36
S8	276833	log$3 near4 (measure$4 or diagnostic$4 or test$3 or comput$4 or calculat$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:39
S9	3130	(addition$3 or more or on adj1 way) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:40
S10	2002	(mobile or wireless or cellular or radio) and S9	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:40
S11	599	(addition$3 or more or on adj1 way) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record) same indicat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO;	OR	ON	2014/03/18 09:40

			DERWENT; IBM_TDB			
S12	381	S10 and S11	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:40
S13	142	(logged or log).ab. and S12	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:40
S14	81	S8 and S13	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 09:40
S15	2	("2012/0040621").URPN.	USPAT	OR	ON	2014/03/18 09:44
S16	37	(addition$3 or more or on adj1 way) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record) and (mdt or manual adj1 test$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 15:55
S17	749	(addition$3 or more or on adj1 way) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record) same (transmit$4 or send$3 or forward$3)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 15:57
S18	931	(addition$3 or more or on adj1 way) near4 (logged or log) near3 (report or message or proceed$3 or account$3 or summarat$3 or record) same (transmit$4 or send$3 or forward$3 or sent)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 15:57
S19	18	S16 and S18	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/03/18 15:57

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PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	13001687
	Filing Date	2010-12-09
	First Named Inventor	PERSSON Hakan
	Art Unit	
	Examiner Name	
	Attorney Docket Number	2380-1599

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13001687
	Filing Date	2010-12-09
	First Named Inventor	PERSSON Hakan
	Art Unit	
	Examiner Name	
	Attorney Docket Number	2380-1599

	1	3GPP TS 37.320, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Universal Terrestrial Radio Access (UTRA) and Evolved Universal Terrestrial Radio Access (E-UTRA); Radio Measurement Collection for Minimization of Drive Tests (MDT); Overall Description; Stage 2 (Release 10), V10.0.0, 2010-12	☐
	2	3GPP TR 36.805, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Study on Minimization of Drive-Tests in Next Generation Networks (Release 9), V9.0.0, 2009-12	☐

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EXAMINER SIGNATURE

Examiner Signature	/Keith Ferguson/	Date Considered	03/18/2014

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.F./

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13001687
	Filing Date	2010-12-09
	First Named Inventor	PERSSON Hakan
	Art Unit	
	Examiner Name	
	Attorney Docket Number	2380-1599

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/H. Warren Burnam, Jr./	Date (YYYY-MM-DD)	2011-10-25
Name/Print	H. Warren Burnam, Jr.	Registration Number	29,366

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /K.F./

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13001687	PERSSON ET AL.
	Examiner	Art Unit
	KEITH FERGUSON	2648

CPC- SEARCHED		
Symbol	Date	Examiner
H04W 24/10	3/19/14	KF

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner
H04B 7/00; G06F 11/34: H04B 7/00	3/19/14	KF

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
455	517,500,507,514,423-425,67.11,445,412.1,412.2,422.1,403,550.1434,522,68,69,426.1,426.2,458,453,	3/19/14	KF
370	241,252,310,328,329,338,343	3/19/14	KF
714	45,25,1	3/19/14	KF

SEARCH NOTES		
Search Notes	Date	Examiner
east search notes including	3/19/14	KF

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
455	517,500,507,514,423-425,67.11,445,412.1,412.2,422.1,403,550.1434,522,68,69,426.1,426.2,458,453,	3/19/14	KF
370	241,252,310,328,329,338,343	3/19/14	KF
714	45,25,1	3/19/14	KF

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/001,687	10/14/2011	Håkan Persson	2380-1599

CONFIRMATION NO. 3427

POA ACCEPTANCE LETTER

5073
BAKER BOTTS L.L.P.
2001 ROSS AVENUE
SUITE 600
DALLAS, TX 75201-2980

OC00000067237178

Date Mailed: 03/25/2014

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/18/2014.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

/ttkim/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/001,687	10/14/2011	Håkan Persson	2380-1599

CONFIRMATION NO. 3427

POWER OF ATTORNEY NOTICE

23117
NIXON & VANDERHYE, PC
901 NORTH GLEBE ROAD, 11TH FLOOR
ARLINGTON, VA 22203

OC00000006723716 3

Date Mailed: 03/25/2014

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 03/18/2014.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

/ttkim/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
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or Fax (571)-273-2885

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(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/001,687	10/14/2011	Håkan Persson	2380-1599	3427

TITLE OF INVENTION: MINIMIZING DRIVE TEST LOGGED DATA REPORTING

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	06/24/2014

EXAMINER	ART UNIT	CLASS-SUBCLASS
FERGUSON, KEITH	2648	455-517000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
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1 Baker Botts L.L.P.
2
3

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Telefonaktiebolaget L M Ericsson (publ)
(B) RESIDENCE: (CITY and STATE OR COUNTRY): Stockholm, Sweden

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
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☐ Applicant asserting small entity status. See 37 CFR 1.27
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☐ Applicant changing to regular undiscounted fee status.
NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature Chad C. Walters Date June 23, 2014
Typed or printed name Chad C. Walters Registration No. 48,022

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	Håkan Persson et al.
Serial No.:	13/001,687
Filed:	October 14, 2011
Group No.:	2648
Examiner:	Keith Ferguson
Notice of Allowance Mailed:	March 24, 2014
Confirmation No.:	3427
Title:	Minimizing Drive Test Logged Data Reporting

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

RESPONSE TO REASONS FOR ALLOWANCE

Applicants appreciate the Examiner's allowance of Claims 1-30. Pursuant to 37 C.F.R. § 1.104, Applicants respectfully issue a statement commenting on the Examiner's reasons for allowance. Applicants respectfully disagree with the Examiner's reasons for allowance to the extent that they are inconsistent with applicable case law, statutes, and regulations. Furthermore, Applicants do not admit to any characterization or limitation of the claims or to any characterization of a reference by the Examiner, particularly any that are inconsistent with the language of the claims considered in their entirety and including all of their constituent limitations.

Respectfully submitted,
BAKER BOTTS L.L.P.
Attorneys for Applicants

Chad C. Walters
Registration No. 48,022

Date: June 23, 2014
CUSTOMER NO. 05073

Active 16202720.1

Electronic Patent Application Fee Transmittal

Application Number:	13001687
Filing Date:	14-Oct-2011
Title of Invention:	MINIMIZING DRIVE TEST LOGGED DATA REPORTING
First Named Inventor/Applicant Name:	Håkan Persson
Filer:	Luke K Pedersen/Meg Collins
Attorney Docket Number:	017997.0227

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**960**

Electronic Acknowledgement Receipt	
EFS ID:	19380472
Application Number:	13001687
International Application Number:	
Confirmation Number:	3427
Title of Invention:	MINIMIZING DRIVE TEST LOGGED DATA REPORTING
First Named Inventor/Applicant Name:	Håkan Persson
Customer Number:	5073
Filer:	Luke K Pedersen/Meg Collins
Filer Authorized By:	Luke K Pedersen
Attorney Docket Number:	017997.0227
Receipt Date:	23-JUN-2014
Filing Date:	14-OCT-2011
Time Stamp:	14:55:20
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$960
RAM confirmation Number	1246
Deposit Account	020384
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1		0179970227_IssueFee.pdf	141519 56b2f725e735ad49db682af1380a2bd8035a2e55	yes	2

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Issue Fee Payment (PTO-85B)	1	1
Post Allowance Communication - Incoming	2	2

Warnings:

Information:

2	Fee Worksheet (SB06)	fee-info.pdf	30503 86b79e301da27d7f9b31813e22e6861c1731daf0	no	2

Warnings:

Information:

Total Files Size (in bytes):	172022

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/001,687	08/05/2014	8798658	017997.0227	3427

5073 7590 07/16/2014

BAKER BOTTS L.L.P.
2001 ROSS AVENUE
SUITE 600
DALLAS, TX 75201-2980

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Håkan Persson, Solna, SWEDEN;
Henrik Enbuske, Stockholm, SWEDEN;
Håkan Palm, Vaxjo, SWEDEN;

PTO/SB/44 (09-07)
Approved for use through 08/31/2013. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 8,798,658 B2

APPLICATION NO. : 13/001,687

ISSUE DATE : August 5, 2014

INVENTOR(S) : Persson, et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In Column 12, Line 26, in Claim 1, delete "Method" and insert - - A method - -, therefor.

In Column 14, Line 6, in Claim 22, delete "Method" and insert - - A method - -, therefor.

MAILING ADDRESS OF SENDER (Please do not use customer number below):

6300 Legacy, MS EVR 1-C-11
Plano, TX 75024
972-583-8656

Electronic Patent Application Fee Transmittal

Application Number:	13001687
Filing Date:	14-Oct-2011
Title of Invention:	MINIMIZING DRIVE TEST LOGGED DATA REPORTING
First Named Inventor/Applicant Name:	Håkan Persson
Filer:	Steven Ware Smith/Kara Coffman
Attorney Docket Number:	017997.0227
Filed as Large Entity	

Filing Fees for U.S. National Stage under 35 USC 371

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Certificate of Correction	1811	1	100	100

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**100**

Electronic Acknowledgement Receipt	
EFS ID:	20891234
Application Number:	13001687
International Application Number:	
Confirmation Number:	3427
Title of Invention:	MINIMIZING DRIVE TEST LOGGED DATA REPORTING
First Named Inventor/Applicant Name:	Håkan Persson
Customer Number:	5073
Filer:	Steven Ware Smith/Kara Coffman
Filer Authorized By:	Steven Ware Smith
Attorney Docket Number:	017997.0227
Receipt Date:	08-DEC-2014
Filing Date:	14-OCT-2011
Time Stamp:	13:32:06
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$100
RAM confirmation Number	10747
Deposit Account	501379
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	P32817-US2_2014-12-08_CoC_Request_Letter.pdf	86801 e5c94772d12f9fdf323753e5cbc3e5e3803766e9	no	3
Warnings:					
Information:					
2	Request for Certificate of Correction	P32817-US2_2014-12-08_CoC_PTO-1050.pdf	101317 2fd833b2700f8c75de186edac934c70dac3eb2e5	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30599 4beb1ebfa2e31956edacf296a87c345cc4602784	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	218717		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF: U.S. Patent No. 8,798,658

USPTO CONFIRMATION CODE: 3427

APPLICATION NO.: 13/001,687

PCT FILED: December 09, 2010

U.S. FILED: October 14, 2011

EXAMINER: Keith Ferguson

GROUP ART UNIT: 2647

FOR: MINIMIZING DRIVE TEST LOGGED DATA REPORTING

37 CFR 1.322 & 37 CFR 1.323 REQUEST FOR CERTIFICATE OF CORRECTION FOR USPTO AND/OR APPLICANT MISTAKE

HONORABLE COMMISSIONER OF PATENTS & TRADEMARKS

SIR:

The following is a request for a certificate of correction in Serial Number 13/001,687, now Patent Number 8,798,658.

A certificate of correction under 35 USC 254 is respectfully requested in the above-identified patent.

All errors were the fault of the applicant and, accordingly, please charge **$100.00** to our Deposit Account No. 50-1379. In the event that a further fee is required, please charge the amount to the same Deposit Account.

The exact locations where the errors appear in the patent and patent application are as follows:

In Column 12, Line 26, in Claim 1, delete “Method” and
insert - - A method - -, therefor.
(AMENDMENTS TO THE CLAIMS DATED DECEMBER 28, 2010, PAGE 4
(PAGE 96 OF FW), CLAIM 1, LINE 1)

In Column 14, Line 6, in Claim 22, delete “Method” and
insert - - A method - -, therefor.
(AMENDMENTS TO THE CLAIMS DATED DECEMBER 28, 2010, PAGE 8
(PAGE 100 OF FW), CLAIM 22, LINE 1)

The requested corrections are attached on Form PTO 1050.

Respectfully Submitted

, 2014

DATE

/Ronald J. Ward,Reg#54870/

Ronald J. Ward
Registration No. 54,870
Attorney of Record

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO.	: 8,798,658 B2
APPLICATION NO.	: 13/001687
DATED	: August 5, 2014
INVENTOR(S)	: Persson et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the Claims

Column 12, Line 26, in Claim 1, delete "Method" and insert -- A method --, therefor.

Column 14, Line 6, in Claim 22, delete "Method" and insert -- A method --, therefor.

Signed and Sealed this
Third Day of March, 2015

Michelle K. Lee

Michelle K. Lee
Deputy Director of the United States Patent and Trademark Office