

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

To:
NOKIA TECHNOLOGIES OY
Ari Aarnio IPR Department
Karakaari 7
FI-02610 Espoo
FINLAND

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FOR FURTHER ACTION
See paragraph 2 below

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See supplemental box

Applicant
NOKIA TECHNOLOGIES OY

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 43bis.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 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 notified the International Bureau under Rule 66.1bis(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.

Name and mailing address of the ISA/FI
Finnish Patent and Registration Office
FI-00091 PRH, FINLAND
Facsimile No. +358 29 509 5328

Date of completion of this opinion
16 October 2018 (16.10.2018)

Authorized officer
Harald Kaaja
Telephone No. +358 29 509 5000

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/FI2018/050570

Box No. I Basis of this 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 43*bis*.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:
 - a. ☐ forming part of the international application as filed:
 - ☐ in the form of an Annex C/ST.25 text file.
 - ☐ on paper or in the form of an image file.
 - b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.
 - c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
 - ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
 - ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).
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 forming part of 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 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

I. Statement

Novelty (N)	Claims ---	YES
	Claims <u>1-24</u>	NO
Inventive step (IS)	Claims ---	YES
	Claims <u>1-24</u>	NO
Industrial applicability (IA)	Claims <u>1-24</u>	YES
	Claims ---	NO

2. Citations and explanations:

2.1 Documents cited

Reference is made to the following documents:

D1: WO 2017119844 A1 (ERICSSON TELEFON AB L M (PUBL) [SE]) 13 July 2017 (13.07.2017)
D2: HUAWEI; HISILICON Update of Solution #1 for Key issue #1. 3GPP (3rd Generation Partnership Project) SA WG2 Meeting #114, [online], 2016-04-05, [retrieved on 2018-10-12]. Retrieved from <http://www.3gpp.org/ftp/tsg_sa/WG2_Arch/TSGS2_114_Sophia_Antipolis/Docs/S2-161503.zip>,
D3: US 2017141973 A1 (VRZIC SOPHIE [CA]) 18 May 2017 (18.05.2017)
D4: WO 2016006948 A1 (LG ELECTRONICS INC [KR]) 14 January 2016 (14.01.2016)
D5: US 2017041854 A1 (KIM JAEHYUN [KR] et al.) 09 February 2017 (09.02.2017)
D6: WO 2013112410 A1 (INTEL CORP [US]) 01 August 2013 (01.08.2013)

Document D1 represents the most relevant prior art and documents D2-D6 represent the general state of the art.

2.2 Claimed invention

The application concerns an invention defined in claims 1-24. The invention generally relates to techniques for detecting a network slice associated with an access attempt, barring decision and network slice-specific load information. The invention is claimed as a method (**claims 1, 13, 18**) and an apparatus (**claims 22-24**). The preferred embodiments of the invention are defined in **dependent claims 2-12, 14-17 and 19-21**.

The aim of the claimed invention is detecting network slice associated with an access attempt and making a barring decision. The barring configuration reduces a load on the wireless network.

Independent claim 1 defines a method, comprising:

- **F1:** detecting, by a user device, a network slice or an application associated with an access attempt by the user device to access a wireless network;
- **F2:** determining, by the user device, an access category based on the detected network slice or detected application; and
- **F3:** making, by the user device, a barring decision for the access attempt based on the determined access category.

Independent claim 13 defines a method, comprising:

- **F4:** receiving, by a base station from one or more core network entities within a wireless network, network slice-specific load information that indicates a load for each of one or more network slices;

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- **F5:** determining, by the base station based on the received network slice-specific load information, a barring configuration that indicates a set of barring parameters for one or more access categories; and;
- **F6:** sending, by the base station to a user device, the barring configuration to reduce a load on the wireless network.

Independent claim 18 defines a method, comprising:

- **F7:** determining, by a core network entity, network slice-specific load information that indicates a load for each of one or more network slices; and;
- **F8:** sending, by the core network entity to a base station, the network-slice specific load information.

Independent claim 22 defines an apparatus comprising means for performing a method of any of claims 1-21.

Independent claim 23 defines an apparatus comprising at least one processor and at least one memory including computer instructions that, when executed by the at least one processor, cause the apparatus to perform a method of any of claims 1-21.

Independent claim 24 defines an apparatus comprising a computer program product including a non-transitory computer-readable storage medium and storing executable code that, when executed by at least one data processing apparatus, is configured to cause the at least one data processing apparatus to perform a method of any of claims 1-21.

All patent claims were subjected to a novelty search.

2.3 Novelty under PCT Article 33(2)

2.3.1 Independent Claims

Document D1 is regarded as the closest prior art (the references given below in parentheses relate to this document):

D1 (Abstract) describes the method transmitting network slice configuration information (NSCI) by a node element, where the NSCI comprises one of information for identifying network slice and information identifying barring status of the network slice for each supported network slice, information for identifying a network slice group and information identifying a barring status for the network slice group for each supported network slice group, and information for identifying the barred network slice group for each supported network slice group that is barred.

D1 discloses the following technical feature (F1-F3) of **method claim 1**, technical features (F4-F6) of **method claim 13** and technical features (F7-F8) of **method claim 18** as follows:

(F1) detecting, by a user device, a network slice or an application associated with an access attempt by the user device to access a wireless network; (paragraphs [004], [0013]-[0016], [0086], [00102]-[00110], figures 7, 16) "... when the WCD is put in use the WCD may first attempt to discover if an authorized network slice is supported and not barred in the area in which the WCD is located ... the discovery process comprises the WCD searching for system information (e.g., a SIB) that is being broadcast by an NE serving the area; receiving the system information; and locating NSCI within the system information, wherein the NSCI identifies a set of supported network slices and the barring status of each supported network slice..."

(F2) determining, by the user device, an access category based on the detected network slice or detected application; and, (paragraphs [0059]-[0060], [0073]-[0075], [00102]-[00110]) "... Access Class

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Continuation of: Box V (2 / 6)

Barring (ACB)... ACB is used for access barring based on WCDs access class (AC),... ACDC provides the operator with some means to bar WCD access for certain application categories via information sent in system information, but requires also that WCDs are preconfigured with such categorization of applications....", "... The WCD then determines, based on the broadcast NSCI and its configuration information identifying the authorized network slices, whether any of the authorized network slices are supported and not barred....".

(F3) making, by the user device, a barring decision for the access attempt based on the determined access category (paragraphs [0086]-[0088], [00103]-[00105], figure 13) "... The WCD may be configured to interpret the absence of system information after request as the access barring for its network slice. Thus, if the WCD transmits the barring status request using the assigned RACH, but NE does not respond to the request, then the WCD will interpret this silence as meaning that the corresponding network slice is barred, and, hence, the WCD will refrain from attempting to use the network slice ... " and also "... If the WCD determines, however, that none of its authorized network slices are supported or that all of its authorized network slices are barred, then the WCD will refrain from attempting to establish network access...".

(F4) receiving, by a base station from one or more core network entities within a wireless network, network slice-specific load information that indicates a load for each of one or more network slices; (paragraphs [009], [0036], [0057]-[0062]) "... the NE comprises: (1) a receive module for receiving from a network management node configuration information concerning at least one of: i) a set of two or more network slices supported by the NE ...", "... in 3GPP system there is some support for protecting common control channels for extensive load from different services. These mechanisms include Access Class Barring (ACB), ...ACB is used for access barring based on WCDs access class (AC),... When the eNB load threshold exceeds, the eNB can start to broadcast ACB parameters in SIB2: All WCDs need to be paged for SI update; and ACB takes place around 10 seconds after initiated...".

(F5) determining, by the base station based on the received network slice-specific load information, a barring configuration that indicates a set of barring parameters for one or more access categories; and; (paragraphs [0057]-[0066]) "... When the eNB load threshold exceeds, the eNB can start to broadcast ACB parameters in SIB2, ...Barring factor and timer broadcast ... Barring behavior in the WCD (AC 0-9) ... There is also a special flavor of ACB covering CS Fallback (CSFB): it allows to down-prioritize (via barring) mobile-originating CSFB calls based on network information broadcast in SIB2 (ac-BarringForCSFB)..."

(F6) sending, by the base station to a user device, the barring configuration to reduce a load on the wireless network. (paragraphs [0018], [0062]-[0066], [0084]-[0086]) "... the network can protect its resources by for example only allowing WCDs belonging to specific network slice(s) to perform access. This could be useful to reduce the risk of signaling storms..." and also "... When the eNB load threshold exceeds, the eNB can start to broadcast ACB parameters in SIB2...Timer determines how long WCDs are barred... the WCD is barred over a random timer; when timer expires, the WCD makes the barring test again...". This also means that available barring configuration mechanism reduces the network load.

(F7) determining, by a core network entity, network slice-specific load information that indicates a load for each of one or more network slices; and; (paragraphs [0075]-[0078]) "... an NM provides configuration information to a DM, which provides configuration information to a node element (NE) (e.g., LTE/NX eNB). The configuration information provided to NE includes network slice information. ... includes information identifying the set of network slices supported by NE and, for each supported network slice, a barring status (e.g., barring level) Each such data pair consists of a network slice identifier for identifying a network slice and information identifying a barring status of the corresponding network slice (e.g., barred, unbarred, or barring level)... the barring level may correspond to a specified WCD behavior..."

(F8) sending, by the core network entity to a base station, the network-slice specific load information. (paragraphs [0075]-[0078], [0089]; figure 9) "... the barring level may correspond to a specified WCD behavior. For example, a barring level of 1 may correspond to a WCD behavior in which the WCD waits X seconds before attempting to access the network following a failed access attempt, whereas a

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barring level of 9 may correspond to a WCD behavior in which the WCD waits Y seconds ($Y \gg X$) before attempting to access the network following a failed access attempt....” and also “... the NE receiving from a network management node (e.g., DM or NM) configuration information concerning a set of two or more network slices supported by the NE; ... the NE transmitting (e.g., broadcasting) network slice configuration information, NSCI, the NSCI comprising, for each supported network slice, information for identifying the network slice and information identifying a barring status of the network slice. ... the barring status information indicating the barring status of the network slice identifies a barring level....”.

Document D2 relates (the whole document) to network slices of the PLMN share radio access separating any access barring and (over)load control per slice. That may be accomplished comparable to today's separated access barring and (over)load control that is provided per PLMN operator for network sharing.

Document D3 presents (the whole document) a method of generating a network slice. The method comprises a network slice orchestrator (NWSO) receiving from a network slice manager (NWSM) a request for a new network slice, the NWSO adding a new service to the new network slice, the NWSO determining a network slice descriptor (NWSD) for the new network slice, the NWSO transmitting to a resource orchestrator (RO) a request for an instantiation of the network slice using enhanced network function virtualization management and orchestration (E-MANO). A method of modifying a network slice is also provided. The method comprises a NWSO receiving from a NWSM a request to add a new service to a network slice, the NWSO adding a new service to the network slice, the NWSO determining a NWSD for the network slice with the added service, and the NWSO transmitting to a RO a request for an instantiation of the added service on the network slice using E-MANO. A method of terminating a network slice is also provided. The method comprises a NWSO receiving from a NWSM a request to terminate a network slice, the NWSO determining the subnetworks to terminate, and the NWSO transmitting to a RO a request for a termination of the slice specific network functions (NFs).

Document D4 presents (the whole document) a method and apparatus for performing application specific access control in a wireless communication system. A user equipment (UE) receives access control related system information from a network, identifies initiation of a specific application, and determines whether or not access attempt for the specific application is allowed, based on the received access control related system information. Accordingly, the UE may determine whether or not to skip access control barring (ACB) check for the specific application, or whether or not to skip random access backoff for the specific application.

Document D5 describes (the whole document) a network access blocking method performed by a user equipment. The method may comprise the steps of: receiving application specific congestion control for data communication (ACDC) blocking information and access class barring (ACB) blocking information; determining the category of an application being executed according to a network access attempt by the application; performing an ACDC blocking check on the basis of the determined category and the received ACDC blocking information. Here, when the network access attempt by the application is not blocked as a result of the ACDC blocking check, an ACB blocking check on the basis of the ACB blocking information may be skipped.

Document D6 describes (the whole document) technology for core network signaling of an extended access barring (EAB) action between a node (e.g., an eNodeB) and a core network (CN) entity (e.g., a mobility management entity (MME)). One method can include a node receiving from a core network entity an EAB action in an overload start message. The node can transmit EAB configuration information from the node to a wireless device based on the received EAB action.

In summary, the subject matter of independent **claims 1, 13 and 18** is not novel in view of document D1. The same reasoning applies to the subject matter of **independent claims 22-24**, which therefore is not novel either.

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2.3.2 Dependent claims

Document D1 discloses the additional features of dependent claims 2-12, 14-17 and 19-21:

- **dependent claim 2** (paragraphs [0010]-[0013], [0077]-[0080], [00103]-[00105]): "... The WCD then determines, based on the broadcast NSCI and its configuration information identifying the authorized network slices, whether any of the authorized network slices are supported and not barred. ..."
- **dependent claim 3** (paragraphs [0047]-[0049], [00104]-[00105], [00108], figure 5): "... If the particular network slice is not barred, then the WCD may attempt to initiate the establishment of an RRC connection with the NE..."
- **dependent claim 4** (paragraphs [0073]-[0074]): "... it provides the operator with some means to bar WCD access for certain application categories via information sent in system information, but requires also that WCDs are preconfigured with such categorization of applications...."
- **dependent claim 5** (paragraphs [0059]-[0064], [0074]-[0078]): "... the operator with some means to bar WCD access for certain application categories via information sent in system information, but requires also that WCDs are preconfigured with such categorization of applications...the NSCI transmitted by NE 806 in a particular area includes a set data pairs, one for each network slice that is supported in the cell. Each such data pair consists of a network slice identifier ... For example, a barring level of 1 may correspond to a WCD behavior in which the WCD waits X seconds before attempting to access the network following a failed access attempt, whereas a barring level of 9 may correspond to a WCD behavior in which the WCD waits Y seconds (Y » X) before attempting to access the network following a failed access attempt...."
- **dependent claim 6** (paragraphs [0013]-[0016], [0060]-[0064], [0074]-[0077], [00103]-[00105]): WCD comprises a receiving module for receiving configuration information, system information corresponding authorized network slices and receiving an index (e.g. SSI) entry that identifies a barring status (e.g. barring level). ACB is used for access barring based on WCDs access class (AC). The operator provides some means to bar WCD access for certain application categories via information sent in system information, but it requires also that WCDs are preconfigured with such categorization of applications. "... The WCD then determines, based on the broadcast NSCI and its configuration information identifying the authorized network slices, whether any of the authorized network slices are supported and not barred...."
- **dependent claims 7, 17, 21** (see paragraphs [0055]-[0062]): "... The key driver for introducing network slicing... e.g., by offering connectivity services with different network characteristics (performance, security, robustness, and complexity)...Network slice 0 can for example be a Mobile Broadband network slice and Network slice 1 can for example be a Machine Type Communication network slice...."
- **dependent claim 8** (see paragraphs [0074]-[0081], [00101]-[00105]; figure 8): ACDC "... provides the operator with some means to bar WCD access for certain application categories via information sent in system information, ... WCDs are preconfigured with such categorization of applications. ... " and also "... operator will configure its subscribers' WCDs with information identifying the network slice (or network slices) that the WCD is authorized to access ...". This also means, at least implicitly, that the operating system (application) identity is determined.
- **dependent claims 9, 16** (paragraphs [0063]-[0064]): "...Barring factor and timer broadcast: Factor (0...1) corresponds to barring probability; Timer determines how long WCDs are barred.... Barring behavior in the WCD (AC 0-9): The WCD draws a random number r. If this random number r is over the barring factor, the WCD is barred over a random timer; when timer expires, the WCD makes the barring test again...."

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- dependent claim 10** (see paragraphs [0047]-[0049], [0078], [0084]-[0088]): "... "RRC Connected Inactive" state designed to be used as the primary sleep state for the 5G access has as one of the characteristics the maintenance of context information by the WCD and the network when the WCD moves from "RRC Connected" to "RRC Connected Inactive"... ", "... In the cases wherein the information identifying the barring status identifies a barring level, the barring level may correspond to a specified WCD behavior. For example, a barring level of 1 may correspond to a WCD behavior in which the WCD waits X seconds before attempting to access the network following a failed access attempt, whereas a barring level of 9 may correspond to a WCD behavior in which the WCD waits Y seconds (Y » X) before attempting to access the network following a failed access attempt. ...". This also means at least implicitly that (e.g., inactive or suspended connection) WCDs are receiving "compensation" configuration, i.e. receiving adjusted barring information of their access attempts.
- dependent claims 11-12, 19-20** (see paragraphs [0056]-[0076], figure 8): "... mechanisms are required to protect common channels or resources used for WCDs accessing system so that congestion in one network slice does not have a negative impact on another network slice (often called network slice isolation). Currently in 3GPP system there is some support for protecting common control channels for extensive load from different services. These mechanisms include Access Class Barring (ACB), Enhanced Access Barring (EAB), Service Specific Access Barring (SSAB), as well as implementation specific admission control... ". **D1 also discloses** that "... There is also a special flavor of ACB covering CS Fallback (CSFB): it allows to down-prioritize (via barring) mobile-originating CSFB calls based on network information broadcast in SIB2... for WCDs in RRC_Connected state and it allows to down-prioritize (via barring) mobile-originating IMS voice and/or video calls based on NAS configuration and network information broadcast in SIB2... allows WCDs appropriately configured by the NAS layer to skip ACB and by doing this it enables prioritization of mobile originating MMTEL video and/or voice and/or SMS. The type of service that can be prioritized is hardcoded in the standard... ". **D1 also presents** "... the operator may instantiate a new Core Network (CN) when a new network slice should be supported... Network slice 0 can for example be a Mobile Broadband network slice and Network slice 1 can for example be a Machine Type Communication network slice... there is some support for protecting common control channels for extensive load from different services... In 3GPP Release 12 the possibility of barring per PLMN was introduced... ". **D1 also discloses** "... an NM 802 provides configuration information to a DM 804, which provides configuration information to a node element (NE) (e.g., LTE/NX eNB) 806. The configuration information provided to NE 806 includes network slice information. ... After NE 806 receives the configuration information, NE 806 transmits (e.g., broadcasts or unicasts) network slice configuration information (NSCI) so that it may be received by WCDs ...".
- dependent claim 14** (paragraphs [0045]-[0049], [00105], figure 5): "... State model for the 5G RAN... the state transitions from RRC Idle to RRC Connected are expected to occur mainly during the first initial access (e.g. when the WCD attaches to the network) or as a fallback case... transitions from "RRC Connected Inactive" to "RRC Connected" are expected to occur quite often The novel "RRC Connected Inactive" state designed to be used as the primary sleep state for the 5G access ... " and also "... If the WCD determines that an authorized network slice is supported and not barred, then the WCD may attempt to initiate the establishment of an RRC connection with the NE...".
- dependent claim 15** (paragraphs [0075]-[0078], figures 8-9): "... NM provides configuration information to a DM, which provides configuration information to a node element (NE) (e.g., LTE/ NX eNB). The configuration information provided to NE includes network slice information. In some embodiments, the network slice information includes information identifying the set of network slices supported by NE and, for each supported network slice, a barring status (e.g., barring level). After NE receives the configuration information, NE transmits (e.g., broadcasts or unicasts) network slice configuration information (NSCI) so that it may be received by WCDs...".

In summary, the subject matter of **dependent claims 2-12, 14-17 and 19-21** is not novel in view of document D1.

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Supplemental Box

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2.4 Inventive step under PCT Article 33(3)

2.4.1 Independent claims

As independent claims 1, 13, 18 and 22-24 are not novel, they do not involve an inventive step, either.

2.4.2. Dependent claims

As dependent claims 2-12, 14-17 and 19-21 are not novel, they do not involve an inventive step, either.

2.5 Industrial applicability under PCT Article 33(4)

Claims 1-24 meet the requirement of industrial applicability because the claimed subject matter can be made or used in industry.

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

Claims are not drafted in the two-part form in accordance with PCT Rule 6.3(b), which in the present case would be appropriate, with those features known from the prior art placed in the preamble (PCT Rule 6.3(b)(i)) and the remaining features included in the characterising part (PCT Rule 6.3(b)(ii)).

The features of the claims are not provided with reference signs placed in parentheses (PCT Rule 6.2(b)).

Contrary to the requirements of PCT Rule 5.1(a)(ii), no relevant prior art is indicated in the description, nor are the documents reflecting such art identified therein.

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:

Although claims 22-24 have been drafted as separate independent claims, they seem to relate effectively to the same subject matter and to differ from each other only with regard to the definition of the subject matter for which protection is sought and in respect of the terminology used for the features of that subject matter. The above claims therefore lack conciseness and as such do not meet the requirements of PCT Article 6.

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of: International Patent Classification (IPC)

IPC

H04W 48/02 (2009.01)

H04W 48/14 (2009.01)

H04W 12/08 (2009.01)

G06F 21/00 (2013.01)

H04L 29/06 (2006.01)