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12275100.1 27 June 2012 (27.06.2012) EP(71) Applicant: **ASTRIUM LIMITED** [GB/GB]; Gunnels
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Aldersgate, London EC1A 4HD (GB).(81) Designated States (unless otherwise indicated, for every
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HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KN, KP, KR,
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[Continued on next page]

(54) Title: AUTHENTICATION OF SATELLITE NAVIGATION SIGNALS

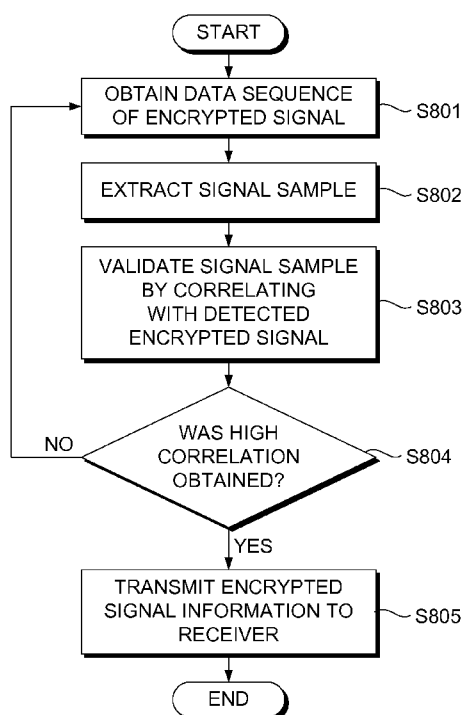


FIG. 8

(57) Abstract: A method and apparatus for providing information about an encrypted signal transmitted by a satellite in a satellite navigation system are disclosed. A data sequence of the encrypted signal as transmitted is obtained, a signal sample is extracted from the data sequence, the signal sample including a part of the data sequence having a length less than a total length of the data sequence, and the signal sample and information about when the data included in the signal sample was transmitted by the satellite are transmitted, as the encrypted signal information, to a receiver for use in the satellite navigation system. A method and apparatus for authenticating an unencrypted signal based on the encrypted signal information are also disclosed. In particular, a time offset between an internal clock of the receiver and an internal clock of the satellite is obtained based on the unencrypted signal, the encrypted signal information is received, a portion of the received encrypted signal is identified that is expected to correspond to the signal sample based on the obtained time offset, the identified portion is correlated with the signal sample, and it is determined that the received unencrypted signal is authentic if a predetermined threshold correlation is obtained.

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19 June 2014

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2013/061297

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/061297

A. CLASSIFICATION OF SUBJECT MATTER
INV. G01S19/21
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)
G01S H04L G06F

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/121087 A1 (PSIAKI MARK L [US]) 17 May 2012 (2012-05-17)	1,2,6-15
A	par. 1-60, fig. 2 -----	3-5
A	US 5 825 887 A (LENNEN GARY R [US]) 20 October 1998 (1998-10-20) the whole document -----	1-15
A	SCOTT L: "Anti-Spoofing & Authenticated Signal Architectures for Civil Navigation Systems", PROCEEDINGS OF ION GPS/GNSS, XX, XX, vol. 2003, 1 January 2003 (2003-01-01), pages 1543-1552, XP002436415, the whole document -----	1-15
A	US 2012/159197 A1 (ORSINI RICK L [US] ET AL) 21 June 2012 (2012-06-21) the whole document -----	3,4



Further documents are listed in the continuation of Box C.



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 application or patent 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

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08/05/2014

Name and mailing address of the ISA/

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2013/061297

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1, 6-15

Satellite signal authentication

2. claims: 1, 3, 4

ensuring that the signal sample is secure and that the data of the encrypted signal cannot be established.

3. claims: 1, 5

Ensuring integrity of the authentication mechanism.
