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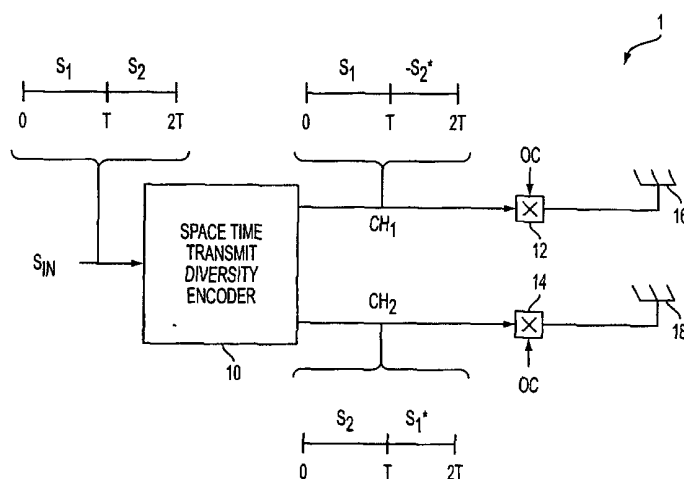
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(54) Title: ADAPTIVE BEAM-TIME CODING METHOD AND APPARATUS



(57) Abstract: A radio system includes a base station and remote station. The base station includes a space-time encoder, an antenna system, a transmitter, a base station receiver, and a power management controller. The space-time encoder encodes a stream of symbols into first and second space-time coded signals, and the transmitter transmits the first and second space-time coded signals at respective first and second initial transmit powers from the antenna system so as to form respective first and second radiation patterns. The base station receiver receives power coefficient indicator information from the remote station, and the power management controller determines first and second adjusted transmit powers based on the respective first and second initial transmit powers and the power coefficient indicator information. In an alternative embodiment, a transmit station of a radio system includes a circuit to determine an angular power spectrum, a space-time encoder, and a transmitter. The space-time encoder encodes first and second symbols into first and second space-time coded signals, and the transmitter transmits the first and second space-time coded signals in respective first and second beams so that the first and second beams are contained within an angular spread of the angular power spectrum.



*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# INTERNATIONAL SEARCH REPORT

In tional Application No

PCT/IB 00/01640

**A. CLASSIFICATION OF SUBJECT MATTER**  
IPC 7 H04B7/005 H04L1/06

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)

IPC 7 H04B H04L H01Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WO 00 36764 A (NOKIA NETWORKS OY ;WICHMAN RISTO (FI); HOTTINEN ARI (FI)) 22 June 2000 (2000-06-22)  abstract page 2, line 11 -page 3, line 29 page 16, line 6 -page 17, line 11 ---	1,2,4,7, 10-12, 37-41, 44,47, 48,52
A	WO 98 09381 A (UNIV LELAND STANFORD JUNIOR) 5 March 1998 (1998-03-05) abstract page 5, line 34 -page 6, line 31 page 19, line 6 - line 28 --- -/--	1-9,16, 37-46,56

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

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"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

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# INTERNATIONAL SEARCH REPORT

International Application No

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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.
A	<p>HEATH R W JR ET AL: "Multiple antenna arrays for transmitter diversity and space-time coding"</p> <p>1999 IEEE INTERNATIONAL CONFERENCE ON COMMUNICATIONS (CAT. NO. 99CH36311), 1999 IEEE INTERNATIONAL CONFERENCE ON COMMUNICATIONS, VANCOUVER, BC, CANADA, 6-10 JUNE 1999,</p> <p>pages 36-40 vol.1., XP002163281</p> <p>1999, Piscataway, NJ, USA, IEEE, USA</p> <p>ISBN: 0-7803-5284-X</p> <p>abstract</p> <p>paragraphs '000I!', '00II!</p> <p>---</p>	1-9, 37-46
A	<p>LO T ET AL: "Space-time block coding-from a physical perspective"</p> <p>WCNC. 1999 IEEE WIRELESS COMMUNICATIONS AND NETWORKING CONFERENCE (CAT. NO.99TH8466), WCNC. 1999 IEEE WIRELESS COMMUNICATIONS AND NETWORKING CONFERENCE, NEW ORLEANS, LA, USA, 21-24 SEPT. 1999,</p> <p>pages 150-153 vol.1, XP002163282</p> <p>1999, Piscataway, NJ, USA, IEEE, USA</p> <p>ISBN: 0-7803-5668-3</p> <p>the whole document</p> <p>---</p>	1-9, 37-46
A	<p>EP 0 905 920 A (LUCENT TECHNOLOGIES INC)</p> <p>31 March 1999 (1999-03-31)</p> <p>abstract</p> <p>page 7, line 11 - line 18</p> <p>---</p>	1,10-12, 37,47, 48,55
A	<p>WO 98 27669 A (CWILL TELECOMMUNICATIONS INC) 25 June 1998 (1998-06-25)</p> <p>abstract</p> <p>page 4, line 10 -page 6, line 16</p> <p>---</p>	1,10-12, 37,47, 48,52
A	<p>EP 0 791 980 A (LUCENT TECHNOLOGIES INC)</p> <p>27 August 1997 (1997-08-27)</p> <p>abstract</p> <p>column 2, line 25 -column 3, line 25</p> <p>-----</p>	16,56

## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/IB 00/01640

### Box I Observations where certain claims were found unsearchable (Continuation of item 1 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 II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

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

see additional sheet

As a result of the prior review under R. 40.2(e) PCT,  
no additional fees are to be refunded.

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 fee, this Authority did not invite payment of any additional fee.
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.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. Claims: 1-15,37-55

Space-time coded signals transmitted in respective beams using closed loop beam power management.

2. Claims: 16-36,56-77

Space-time coded signals transmitted in respective beams using open loop beam pointing and width management.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

In International Application No

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