



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top; border: none; padding: 5px;"> (21) International Application Number: PCT/AU91/00574 (22) International Filing Date: 11 December 1991 (11.12.91) (30) Priority data: PK 3901 12 December 1990 (12.12.90) AU (71) Applicant (for all designated States except US): OTC LIMITED [AU/AU]; 231 Elizabeth Street, Sydney, NSW 2000 (AU). (72) Inventors; and (75) Inventors/Applicants (for US only): ANIDO, Gary, J. [AU/AU]; 69 Mountview Avenue, Narwee, NSW 2209 (AU). FOLLETT, Douglas, James [AU/AU]; 4 Colin Place, Carlingford, NSW 2118 (AU). (74) Agent: WATERMARK PATENT & TRADEMARK ATTORNEYS; 2nd Floor, The Atrium, 290 Burwood Road, Hawthorn, VIC 3122 (AU). </td> <td style="width: 50%; vertical-align: top; border: none; padding: 5px;"> (81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC (European patent), MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, SD, SE, SE (European patent), SN (OAPI patent), SU⁺, TD (OAPI patent), TG (OAPI patent), US. Published <i>With international search report.</i> </td> </tr> </table>			(21) International Application Number: PCT/AU91/00574 (22) International Filing Date: 11 December 1991 (11.12.91) (30) Priority data: PK 3901 12 December 1990 (12.12.90) AU (71) Applicant (for all designated States except US): OTC LIMITED [AU/AU]; 231 Elizabeth Street, Sydney, NSW 2000 (AU). (72) Inventors; and (75) Inventors/Applicants (for US only): ANIDO, Gary, J. [AU/AU]; 69 Mountview Avenue, Narwee, NSW 2209 (AU). FOLLETT, Douglas, James [AU/AU]; 4 Colin Place, Carlingford, NSW 2118 (AU). (74) Agent: WATERMARK PATENT & TRADEMARK ATTORNEYS; 2nd Floor, The Atrium, 290 Burwood Road, Hawthorn, VIC 3122 (AU).	(81) Designated States: AT, AT (European patent), AU, BB, BE (European patent), BF (OAPI patent), BG, BJ (OAPI patent), BR, CA, CF (OAPI patent), CG (OAPI patent), CH, CH (European patent), CI (OAPI patent), CM (OAPI patent), CS, DE, DE (European patent), DK, DK (European patent), ES, ES (European patent), FI, FR (European patent), GA (OAPI patent), GB, GB (European patent), GN (OAPI patent), GR (European patent), HU, IT (European patent), JP, KP, KR, LK, LU, LU (European patent), MC (European patent), MG, ML (OAPI patent), MN, MR (OAPI patent), MW, NL, NL (European patent), NO, PL, RO, SD, SE, SE (European patent), SN (OAPI patent), SU ⁺ , TD (OAPI patent), TG (OAPI patent), US. Published <i>With international search report.</i>	
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(54) Title: MULTICASTING IN A FPS SWITCH					
<div style="text-align: center; margin-bottom: 20px;"> </div> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%; text-align: center; vertical-align: middle; padding: 5px;"> U / M </td> <td style="width: 35%; text-align: center; vertical-align: middle; padding: 5px;"> ADDRESS </td> <td style="width: 50%; text-align: center; vertical-align: middle; padding: 5px;"> <u>12</u> </td> </tr> </table>			U / M	ADDRESS	<u>12</u>
U / M	ADDRESS	<u>12</u>			
(57) Abstract <p>A system and network are disclosed for providing multicasting capability within a packet switched network, such as FPS or ATM. Each packet's header includes a type indicator bit or bits. One form of type indicator indicates normal port to port switching; a second form indicates switching to a single port, and then to each of a set of outputs defined by the address portion of the header via a separate connection. Contention is thereby reduced in the switching fabric itself.</p>					

+ DESIGNATIONS OF "SU"

Any designation of "SU" has effect in the Russian Federation. It is not yet known whether any such designation has effect in other States of the former Soviet Union.

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MULTICASTING IN A FPS SWITCH

FIELD OF INVENTION

The present invention relates to the provision of multicasting or broadcasting capability within a fast packet switched (FPS), asynchronous transfer mode (ATM) or
5 similar communications network.

BACKGROUND

In the course of switching packetised data, it is often desirable to enable a single data stream comprising one or more packets to be sent to more than one address. This is known as multicasting. If all destinations are addressed, it is termed a broadcast.

10 One means of providing such a facility is to simply insert many packets into the switch inputs, each addressed to a desired output but carrying the same data. This creates a large demand on switching capacity for what is, essentially, one data stream.

Known packet broadcast or multicast arrangements such as that shown in US Patent Nos. 4991171 and 5001702 to Teraslinna et al, generally require replication
15 of packets within the switching fabric. This leads to increased complexity of the switching fabric in requiring additional stages within the fabric and/or different internal switching elements which have more functional complexity. The replication of packets leads to greater contention and congestion within the fabric.

It is therefore an object of the present invention to provide a multicasting
20 capacity without placing unacceptable demands on the switching fabric.

SUMMARY OF INVENTION

According to one aspect the present invention comprises a packet switching network comprising switching means having a plurality of inputs and a plurality of outputs, and port control means associated with each output and with each input,

25 wherein packets comprise a header including an address, and a payload, characterised in that each header further comprises a type indicator, such that each packet having a first type indicator is switched to a one of said outputs defined by the address portion, and is then communicated directly to the port control means associated with the addressed output,

30 and each packet having a second type indicator is switched to a single one of said outputs, and is then communicated via a separate communications connection to one or more of said port control means.

According to another aspect the present invention comprises a method of multicasting within a packet switching network, said network comprising switching
35 means having a plurality of inputs and outputs, port control means associated with each

output, and means for communicating independent of said switching means connecting a defined output of said switching means and a plurality of said port control means,

said packets comprising a header including a type indicator and an address, and a payload,

5 wherein packets having a unicast type indicator are switched by said switching means to an output defined by the respective address and then to the respective port control means,

and packets having a multicast type indicator are switched by said switching means to said defined output and communicated via said means for communicating to a set
10 of output port control means defined by the respective address.

BRIEF DESCRIPTION OF DRAWINGS

The invention will be described in more detail with reference to the accompanying figures, in which:

Figure 1 is a schematic block diagram of one embodiment of the inventive
15 arrangement;

Figure 2 shows one suitable packet format for the inventive arrangement; and

Figure 3 illustrates in block form an output switch port controller.

DETAILED DESCRIPTION

Referring to Figure 1, this illustrates a 4-port system 10 capable of
20 switching 4 inputs to any of 4 outputs, via switching Fabric unit (SFU) 20. It should be appreciated that the exact switching fabric implementation, except in so far as it must be capable of the functions defined below, is not an essential element of the invention. Similarly, a 4-port unit is illustrated only from the point of view of simplicity: practical switching units generally involve at least 16 x 16 units, and may be of much
25 greater complexity. Indeed, the present invention becomes more advantageous as complexity is increased.

SFU 20 has 4 ports 0 - 3, each with an associated switch port controller (SPC) 300 - 303. SPC's provide an interface between various data formats and the packetised data switched by SFU 20. Preferably, the SFU 20 is adapted to switch fixed-
30 length packets, although the present invention is also applicable to variable length packets.

SPC's 300 - 303 also control the input and output packet flows to and from SFU 20. Each SPC according to this embodiment of the invention has at least 2 connections to the SFU 20: a multicast address connection, and a unicast address
35 connection. The exception is SPC 300, in which these connections may share the same

physical connection. SPC's 301 - 303 are connected to unicast addressed ports by connections 25, and to multicast output from the switch by connections 28.

The switching system will be better understood with reference to Figure 2. Each packet comprises a payload 12 and header 13, the header including a tag bit 5 indicating whether the packet has a unicast or multicast address (U/M), and an address field.

SPC's 300 - 303 generate a header 13 for each incoming packet as described so as to facilitate switching according to the present invention. This header 13 is generated by reference to a look-up table and the existing header and address of the 10 external packet. The table includes instructions as to whether header 13 should have a unicast or multicast tag bit.

It should be appreciated that an important distinction between the present invention and prior art techniques is that the switch per se has only to switch one packet - multicast packets are disseminated via one port to a separate communications path for 15 this purpose alone.

Following is a description which uses a simple bit set/not set technique to determine addressing within the multicast path of the switching system. However, the invention may be used with a wide range of other addressing techniques, as will be apparent to the reader. For instance an implementation is possible where the multicast 20 address must be compared with a software - set table to determine whether given ports are addressed, so that multicast groups can be defined in advance. Such an implementation is particularly applicable to larger number of ports switched.

According to the embodiment illustrated, the meaning of the address depends upon the setting of the U/M bit. If the U/M bit indicates unicast, the address is the 25 binary value of the destination switch port. In the multicast case each bit of the address will indicate that a particular switch port is addressed.

An example of single address and multicast addressing is provided to clarify the system operation.

A packet with a U/M tag indicating unicast address of 2 is input by SPC to SFU 30 20, where it is switched to port 2, to the unicast port of SPC 302, and then outputs.

A packet with a U/M tag indicating a multicast address in which bits 0 and 2 are set is input by an SPC to SFU 20. All packets with a multicast address tag are switched by SFU to port 0, and presented by multicast connection 28 to the multicast ports of each SPC. Each SPC 300 - 303 sees the packet on the multicast connection 28 35 and reads it in only if there is a match between the number of the SPC and a bit set in the

multicast address. SPC's 300 and 302 therefore read in the packet and send it to their respective outputs.

SPC 300 is preferably chosen to be a port having comparatively low levels of traffic, as it receives any packets which are unicast to it, and the link between port 0 and
5 SPC 300 additionally carries all multicast addressed traffic. SPC 300 only reads packets unicast to it or packets with a multicast address in which bit 0 is set.

Figure 3 illustrates the output part of an SPC, such as SPC 301: what we may term the output switch port controller (OSPC) 30, as it handles packets output by SFU 20 from a port. FIFO 40 receives unicast addressed packets over the unicast
10 connection 25 from a port of SFU 20. FIFO 41 receives multicast addressed packets via multicast connections 28 from port 0. In the case of SPC 300, connections 25 and 28 are joined at the input to the OSPC 30.

Each packet arriving at FIFO 40 is forwarded to comparator 44 which checks that the packet contains a write address which matches the SPC number contained in
15 register 45. If so, the input is accepted and sent to the corresponding output.

Each packet arriving at FIFO 41 is forwarded to comparator 42, which checks that the packet contains a multicast address, and that there is a match between the bit specified in register 43 as designating that port and the corresponding address bit.

It will be appreciated that the embodiment described is illustrative only, and
20 that variations and additions are possible within the scope of the invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A packet switching network comprising switching means having a plurality of inputs and a plurality of outputs, and port control means associated with each output and with each input,

wherein packets comprise a header including an address, and a payload,

characterised in that each header further comprises a type indicator, such that each packet having a first type indicator is switched to a one of said outputs defined by the address portion, and is then communicated directly to the port control means associated with the addressed output,

and each packet having a second type indicator is switched to a single one of said outputs, and is then communicated via a separate communications connection to one or more of said port control means.

2. A network according to claim 1, wherein said second type indicator defines the packet as a multicast packet directed to a set of port control means defined by the address.

3. A method of multicasting within a packet switching network, said network comprising switching means having a plurality of inputs and outputs, port control means associated with each output, and means for communicating independent of said switching means connecting a defined output of said switching means and a plurality of said port control means,

said packets comprising a header including a type indicator and an address, and a payload,

wherein packets having a unicast type indicator are switched by said switching means to an output defined by the respective address and then to the respective port control means,

and packets having a multicast type indicator are switched by said switching means to said defined output and communicated via said means for communicating to a set of output port control means defined by the respective address.

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Fig 1.

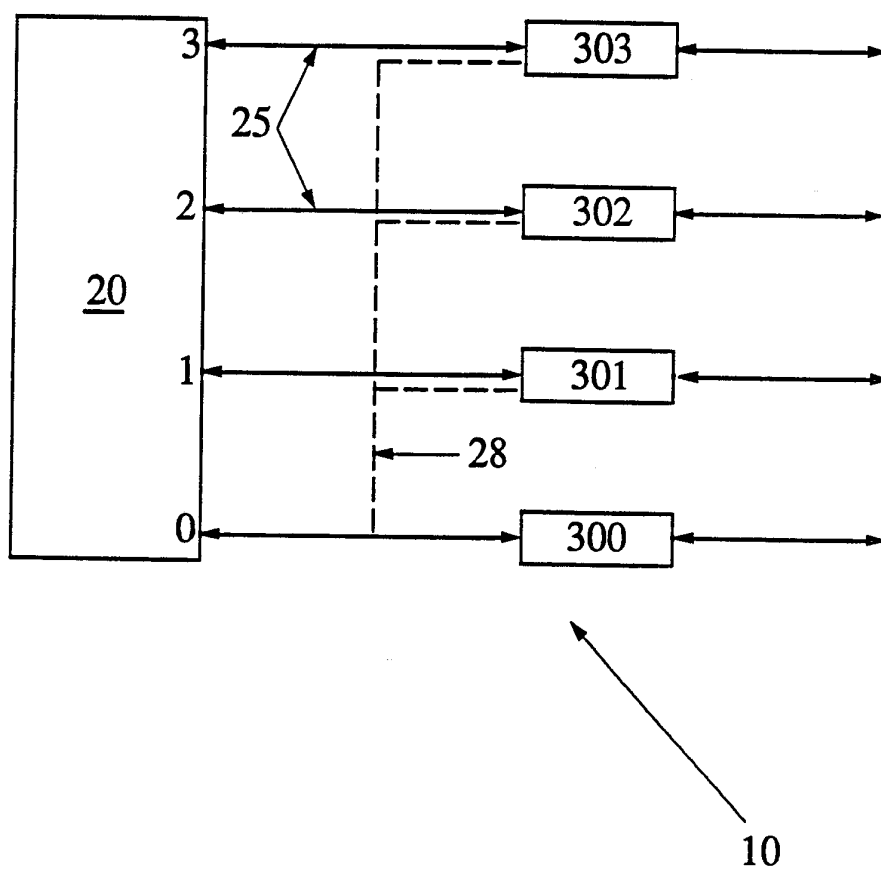
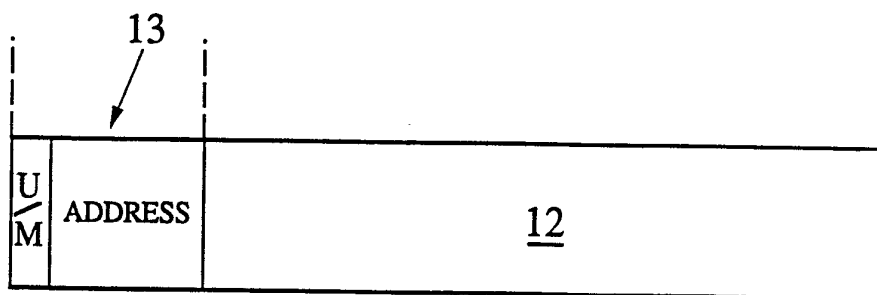
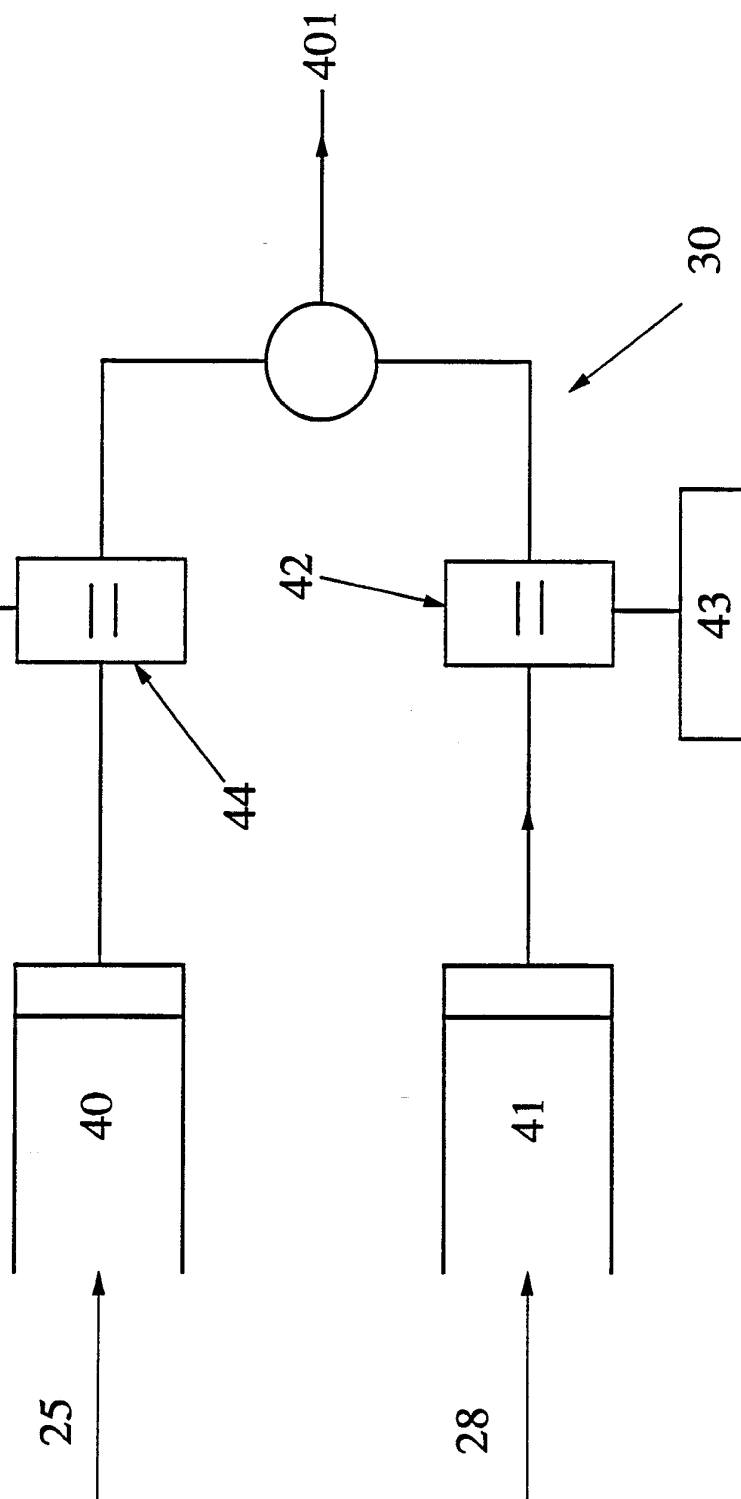


Fig 2.



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Fig 3.



INTERNATIONAL SEARCH REPORT

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶				
According to International Patent classification (IPC) or to both National Classification and IPC Int. Cl. ⁸ H04L 12/56, 12/18				
II. FIELDS SEARCHED				
Minimum Documentation Searched ⁷				
Classification System	Classification Symbols			
IPC	H04L 12/56, 12/18, 11/20, 11/18			
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched ⁸				
AU : IPC as above				
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹				
Category [*]	Citation of Document, ¹¹ with indication, where appropriate of the relevant passages ¹²	Relevant to Claim No ¹³		
X,P	EP,A, 446493 (ALCATEL N.V.) 18 September 1991 (18.09.91) See abstract, column 2 line 39 to column 3 line 2.	(1-3)		
X	WO,A, 8700372 (AMERICAN TELEPHONE & TELEGRAPH COMPANY) 15 January 1987 (15.01.87) See page 3 line 25 to page 6 line 10.	(1-3)		
X	WO,A, 8603355 (AMERICAN TELEPHONE & TELEGRAPH COMPANY) 5 June 1986 (05.06.86) See page 2 line 25 to page 5 line 30.	(1-3)		
A	WO,A, 8404011 (AMERICAN TELEPHONE & TELEGRAPH COMPANY) 11 October 1984 (11.10.84)			
(continued)				
<p>[*] Special categories of cited documents : ¹⁰</p> <table border="0"> <tr> <td style="vertical-align: top;"> <p>"A" Document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </td> <td style="vertical-align: top;"> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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</p> <p>"&" document member of the same patent family</p> </td> </tr> </table>			<p>"A" Document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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</p> <p>"&" document member of the same patent family</p>
<p>"A" Document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p>	<p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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</p> <p>"&" document member of the same patent family</p>			
IV. CERTIFICATION				
Date of the Actual Completion of the International Search 12 March 1992 (12.03.92)	Date of Mailing of this International Search Report 24 MARCH 1992 (24.03.92)			
International Searching Authority AUSTRALIAN PATENT OFFICE	Signature of Authorized Officer P.P. GERONDAL <i>PP Gerondal</i>			

FURTHER INFORMATION CONTINUED FROM THE SECOND SHEET

X	Proceedings of the IEEE, vol 78, No.1, January 1990, F.A. TOBAGI, "Fast Packet Switch Architectures For Broadband Integrated Services Digital Networks". See pages 146-149.	1-3
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V. ☐ OBSERVATIONS WHERE CERTAIN CLAIMS WERE FOUND UNSEARCHABLE ¹

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

1. ☐ Claim numbers ..., because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim numbers ..., 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. ☐ Claim numbers ..., because they are dependent claims and are not drafted in accordance with the second and third sentences of PCT Rule 6.4a

VI. ☐ OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING ²

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

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims of the international application.
2. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims of the international application for which fees were paid, specifically claims:
3. ☐ 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 claim numbers:
4. ☐ As all searchable claims could be searched without effort justifying an additional fee, the International Searching Authority did not invite payment of any additional fee.

Remark on Protest

- ☐ The additional search fees were accompanied by applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 91/00574

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
EP	446493	AU 72606/91	CA 2037976	EP	446493
WO	8700372	CA 1258113 US 4701906	EP 446493	JP	62503207
WO	8404011	CA 1207926 ES 8604752	DE 3484087 IT 1173757	EP 138949 JP 60500936	
WO	8603355	CA 1240022 ES 8608947	DE 3579455 JP 62501045	EP 203990 US 4651318	