(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
27 December 2007 (27.12.2007)

PCT

(10) International Publication Number
WO 2007/149213 A3

(51) International Patent Classification:
H04J 14/02 (2006.01) *H04B 10/18* (2006.01)

(21) International Application Number:
PCT/US2007/013185

(22) International Filing Date: 4 June 2007 (04.06.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/810,586 2 June 2006 (02.06.2006) US
60/923,827 16 April 2007 (16.04.2007) US

(63) Related by continuation (CON) or continuation-in-part (CIP) to earlier applications:
US 60/810,586 (CIP)
Filed on 2 June 2006 (02.06.2006)
US 60/923,827 (CIP)
Filed on 16 April 2007 (16.04.2007)

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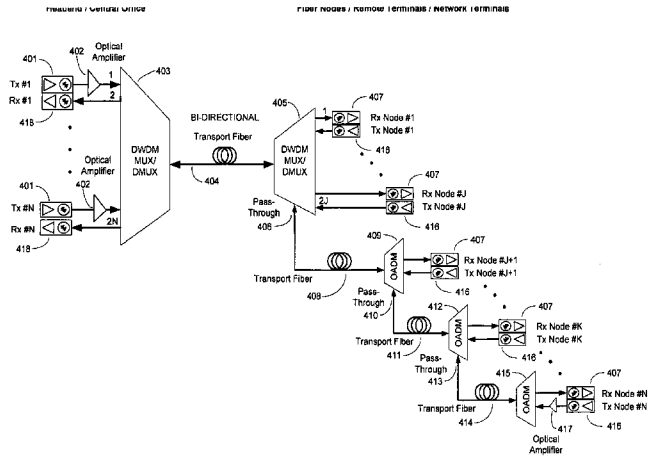
(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, 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, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US (patent), UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM,

[Continued on next page]

(54) Title: DWDM TRANSPORT OF CATV AND DIGITAL SIGNALS OVER OPTICAL FIBER IN LOW-DISPERSION SPECTRAL REGIONS



(57) Abstract: Methods and apparatus are described for DWDM transport of CATV and digital signals over optical fiber in low-dispersion spectral regions. A method includes transporting a plurality of optical carriers of different wavelengths over an optical link using wavelength division multiplexing, the optical link including a plurality of optical segments. The plurality of optical channel center wavelengths defined by the plurality of optical carriers are clustered proximate an average value of a zero-dispersion wavelength of the optical link, or near either a) a low wavelength edge or b) a high wavelength edge of a range of zero-dispersion wavelengths of the optical link and a plurality of optical channel center frequencies defined by the plurality of optical channel center wavelengths are non-uniformly spaced apart.

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ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:
17 July 2008

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/013185

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04J14/02 H04B10/18

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)
H04J H04B

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, INSPEC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 407 842 B1 (MA XIAOBING [US]) 18 June 2002 (2002-06-18) abstract column 1, line 65 - column 2, line 8 column 2, line 49 - column 3, line 11 column 4, line 16 - line 32 claim 1	1-12,15
X	US 6 545 780 B1 (TAKACHIO NOBORU [JP] ET AL) 8 April 2003 (2003-04-08) abstract column 1, line 24 - column 2, line 6 column 3, line 66 - column 4, line 54 column 8, line 56 - line 61 column 9, line 38 - line 44	1-12,15

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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
26 November 2007	29/05/2008

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, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Chauvet, Christophe

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/013185

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SHIGEKI AISAWA ET AL: "Performance of NRZ-Versus RZ-WDM Transmission Around Zero Dispersion Wavelength Over Dispersion-Shifted Fiber" IEEE PHOTONICS TECHNOLOGY LETTERS, IEEE SERVICE CENTER, PISCATAWAY, NJ, US, vol. 10, no. 4, April 1998 (1998-04), XP011045981 ISSN: 1041-1135 page 615	1-12,15
X	WO 99/43118 A (MCI WORLDCOM INC [US]) 26 August 1999 (1999-08-26) abstract page 11, line 20 - page 12, line 14	1-12,15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2007/013185

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 allsearchable 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 reportcovers 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.:

1-12, 15

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.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

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

1. claims: 1-12,15

Methods comprising transporting a plurality of optical carriers of different wavelengths over a transport fiber using wavelength division multiplexing, wherein a plurality of optical channel center wavelengths defined by the plurality of optical carriers are clustered proximate a zero dispersion wavelength of the transport fiber and wherein a plurality of optical channel center frequencies defined by the plurality of optical channel center wavelengths are non-uniformly spaced apart, the optical channel center frequencies being selected to meet alternative conditions (cf. dependent claims 2-5, 7-11); corresponding apparatuses.

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2. claims: 13, 14, 16 ,17

Apparatuses comprising a low dispersion wavelength division multiplexing network transporting a plurality of optical carriers of different wavelengths using wavelength division multiplexing, the low dispersion wavelength division multiplexing network including an optical multiplexer; a transport fiber coupled to the multiplexer; and an optical demultiplexer coupled to the transport fiber, wherein a plurality of optical channel center wavelengths defined by the plurality of optical carriers are clustered proximate a zero dispersion wavelength of the transport fiber and wherein a plurality of optical channel center frequencies defined by the plurality of optical channel center wavelengths are non-uniformly spaced apart, wherein a pass-band width of at least one member selected from the group consisting of the optical multiplexer, the optical demultiplexer, an optical add/drop multiplexer and an optical filter rejects four-wave mixing products during multiplexing or demultiplexing (claims 13 and 16) or wherein offsets of the mixing products from the wavelength division multiplexing channels are all larger than a passband of wavelength division multiplexing filters used for multiplexing and demultiplexing (claims 14 and 17).

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3. claim: 18

System comprising a plurality of optical carriers generated by optical laser transmitters at a plurality of different optical frequencies are multiplexed onto a single transport fiber, wherein each of the plurality of different optical frequencies containing sub-carrier multiplexed analog video and RF QAM signals occupying several octaves and wherein these optical frequencies all lie within a narrow range of within approximately 50 nm of the zero-dispersion wavelength of the single transport fiber.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2007/013185

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6407842 B1	18-06-2002	NONE	
US 6545780 B1	08-04-2003	NONE	
WO 9943118 A	26-08-1999	CA 2321500 A1	26-08-1999
		EP 1053614 A1	22-11-2000
		JP 2002504777 T	12-02-2002
		MX PA00008183 A	04-06-2002