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**Declarations under Rule 4.17:**

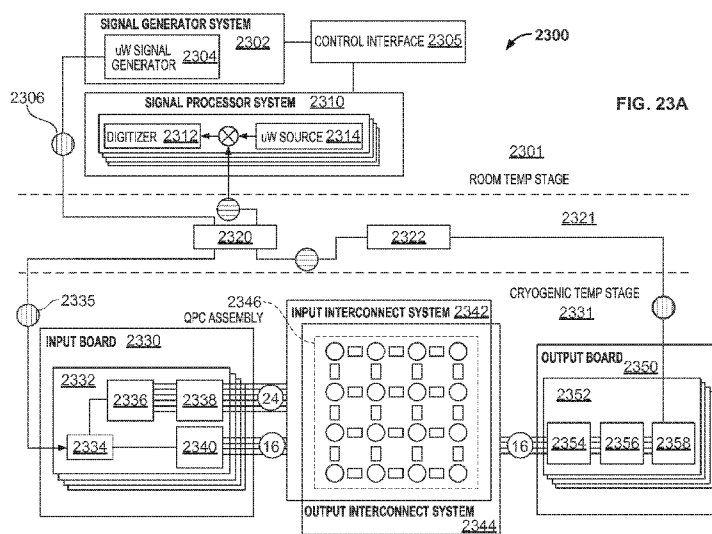
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))

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[Continued on next page]

(54) Title: PROCESSING SIGNALS IN A QUANTUM COMPUTING SYSTEM



(57) Abstract: In some aspects, a quantum computing system includes a control system and a quantum processor cell. The control system generates quantum processor control information for a group of devices housed in the quantum processor cell, and each device in the group has a distinct operating frequency. In some cases, a waveform generator generates a multiplexed control signal based on the quantum processor control information, and the multiplexed control signal is communicated an input signal processing system. In some cases, the input signal processing system includes an input channel configured to receive the multiplexed control signal, a de-multiplexer configured to separate device control signals from the multiplexed control signal, and output channels configured to communicate the respective device control signals into the quantum processor cell.

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— *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))*

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**A. CLASSIFICATION OF SUBJECT MATTER****G06N 99/00(2010.01)i**

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)

G06N 99/00; H04L 9/08; H01L 39/02; G06J 1/00; G01V 3/00; H04B 10/02; G06F 9/06; G06F 15/76; H01L 39/22

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) &amp; Keywords: quantum computing system, quantum processor cell, operating frequency, multiplexer, de-multiplexer, qubit device, waveform generator, readout device, and similar terms.

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2012-0005456 A1 (ANDREW J. BERKLEY et al.) 05 January 2012 See paragraph [0050]; and figure 3.	1-77
A	US 2008-0109500 A1 (WILLIAM MACREADY et al.) 08 May 2008 See paragraphs [0042]-[0084]; and figures 1A-3.	1-77
A	WO 2012-044149 A1 (MIMOS BHD.) 05 April 2012 See page 4, line 16 - page 6, line 7; and figure 1.	1-77
A	US 2013-0005580 A1 (PAUL BUNYK et al.) 03 January 2013 See paragraphs [0033]-[0074]; and figures 1A-2B.	1-77
A	US 2012-0319684 A1 (JAY M. GAMBETTA et al.) 20 December 2012 See paragraphs [0031]-[0048]; and figures 1-3.	1-77

 Further documents are listed in the continuation of Box C. See patent family annex.

\* Special categories of cited documents:

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"E" earlier application or patent but published on or after the international filing date

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"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

"&amp;" document member of the same patent family

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**INTERNATIONAL SEARCH REPORT**

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date		
US 2012-0005456 A1	05/01/2012	AU 2007-329156 A1	12/06/2008		
		AU 2007-329156 B2	13/09/2012		
		CA 2669816 A1	12/06/2008		
		CN 101548288 A	30/09/2009		
		CN 101548288 B	24/04/2013		
		EP 2126800 A1	02/12/2009		
		EP 2126800 A4	11/07/2012		
		JP 05313912 B2	09/10/2013		
		JP 2010-511946 A	15/04/2010		
		KR 10-1446943 B1	06/10/2014		
		KR 10-2009-0090326 A	25/08/2009		
		US 2008-0215850 A1	04/09/2008		
		US 2011-0055520 A1	03/03/2011		
		US 7876248 B2	25/01/2011		
		US 8035540 B2	11/10/2011		
		US 8604944 B2	10/12/2013		
		WO 2008-067664 A1	12/06/2008		
		US 2008-0109500 A1	08/05/2008	US 2012-0215821 A1	23/08/2012
				US 8195726 B2	05/06/2012
				US 8874629 B2	28/10/2014
WO 2007-147243 A1	27/12/2007				
WO 2012-044149 A1	05/04/2012	MY 150189 A	13/12/2013		
		WO 2012-044149 A8	08/11/2012		
		WO 2012-053883 A1	26/04/2012		
US 2013-0005580 A1	03/01/2013	CA 2719343 A1	01/10/2009		
		CN 101978368 A	16/02/2011		
		EP 2263166 A2	22/12/2010		
		EP 2263166 A4	30/07/2014		
		JP 05296189 B2	25/09/2013		
		JP 2011-524026 A	25/08/2011		
		US 2011-0022820 A1	27/01/2011		
		US 2014-0329687 A1	06/11/2014		
		US 8421053 B2	16/04/2013		
		US 8772759 B2	08/07/2014		
		WO 2009-120638 A2	01/10/2009		
		WO 2009-120638 A3	17/12/2009		
US 2012-0319684 A1	20/12/2012	CN 103563084 A	05/02/2014		
		CN 103582949 A	12/02/2014		
		DE 112012001735 T5	13/03/2014		
		DE 112012001847 T5	16/01/2014		
		GB 201400204 D0	26/02/2014		
		GB 201400205 D0	26/02/2014		
		GB 2506077 A	19/03/2014		
		GB 2507208 A	23/04/2014		
		US 2012-0319085 A1	20/12/2012		

**INTERNATIONAL SEARCH REPORT**

Information on patent family members

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**PCT/US2015/018167**

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2012-0326720 A1	27/12/2012
		US 8642998 B2	04/02/2014
		WO 2012-173711 A1	20/12/2012
		WO 2012-173712 A1	20/12/2012