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12/411,322 25 March 2009 (25.03.2009) US(71) Applicant (for all designated States except US): **QUALCOMM INCORPORATED** [US/US]; Attn: International Ip Administration, 5775 Morehouse Drive, San Diego, CA 92121 (US).

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[Continued on next page]

(54) Title: SCRAMBLING AND MODULATION TO CONSTRAIN THE CONSTELLATION SIZE OF ACK/NAK TRANSMISSION ON THE DATA CHANNEL

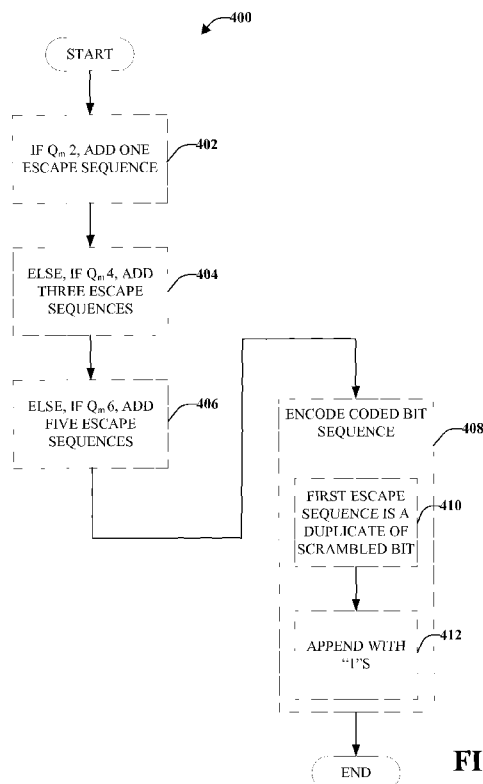


FIG. 4

(57) Abstract: Aspects describe maximizing a Euclidean distance for an ACK transmission as a function of the number of bits in a HARQ-ACK and a modulation order. Encoding includes placing escape sequences in the HARQ-ACK, wherein the number of escape sequences is based on the number of bits and the modulation order. Multiple encoded ACK blocks are combined to obtain a vector sequence that is multiplexed with the encoded data and interleaved, such as on a "time-first" manner. Scrambling is performed as a function of the size and the modulation order. For a 1-bit ACK, the scrambling is performed to achieve any two corners in any constellation for transmission for the ACK. For a 2-bit ACK, the scrambling is performed to achieve any four corners in any constellation for transmission for the ACK.



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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))*

Published:

- *with international search report (Art. 21(3))*
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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
INV. H04L1/16

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)
H04L

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2005/015941 A (QUALCOMM INC [US]; TIEDEMANN EDWARD G JR [US]; DAMNJANOVIC ALEKSANDAR) 17 February 2005 (2005-02-17) paragraphs [0002], [0043], [0206] paragraphs [0211], [0213], [0214] figure 8	1-3, 10, 17-20
A	EP 0 302 622 A (NORTHERN TELECOM LTD [CA]) 8 February 1989 (1989-02-08) page 2, column 1, line 42 - page 2, column 2, line 18 page 3, column 1, line 3 - page 3, column 2, line 15 figure 4 ----- -/--	

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

☒ See patent family annex.

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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.
P,X	WO 2008/140827 A (NOKIA SIEMENS NETWORKS GMBH [DE]; CHINDAPOL AIK [US]; MARCHENKO NIKOLA) 20 November 2008 (2008-11-20) the whole document -----	1-3,10, 17-20
P,X	US 2009/042558 A1 (SHEN ZUKANG [US] ET AL) 12 February 2009 (2009-02-12) the whole document -----	1-3,10, 17-20
P,X	WO 2009/029511 A (INTERDIGITAL PATENT HOLDINGS I [US]; AGHILI BEHROUZ [US]; RUDOLF MARIA) 5 March 2009 (2009-03-05) the whole document -----	1-3,10, 17-20
E	WO 2009/044367 A (NOKIA SIEMENS NETWORKS OY [FI]; NOKIA INC [US]; CHE XIANG GUANG [CN];) 9 April 2009 (2009-04-09) the whole document -----	1-3,10, 17-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 2005015941	A	17-02-2005	AT 381872 T	15-01-2008
			BR PI0413311 A	10-10-2006
			CA 2535040 A1	17-02-2005
			DE 602004010828 T2	04-12-2008
			EP 1661428 A2	31-05-2006
			ES 2297482 T3	01-05-2008
			JP 2007501575 T	25-01-2007
			KR 20060056984 A	25-05-2006
			MX PA06001491 A	15-05-2006
			US 2005030964 A1	10-02-2005
EP 0302622	A	08-02-1989	CA 1274929 A1	02-10-1990
			DE 3889507 D1	16-06-1994
			DE 3889507 T2	25-08-1994
			JP 1055932 A	02-03-1989
WO 2008140827	A	20-11-2008	NONE	
US 2009042558	A1	12-02-2009	NONE	
WO 2009029511	A	05-03-2009	US 2009052378 A1	26-02-2009
WO 2009044367	A	09-04-2009	US 2009129317 A1	21-05-2009