US 20220385308A1

(19) United States

(12) Patent Application Publication (10) Pub. No.: US 2022/0385308 A1

HAMELIN et al. (43) Pub. Date: Dec. 1, 2022

(54) METHOD, SYSTEM, AND APPARATUS FOR A SEGMENTED POLARIZATION-ADJUSTED CONVOLUTIONAL (PAC) CODE

(71) Applicants: **LOUIS-PHILIPPE HAMELIN**, Montreal (CA); **HARSH AURORA**, Montreal (CA); **YIQUN GE**, Kanata (CA)

(72) Inventors: **LOUIS-PHILIPPE HAMELIN**, Montreal (CA); **HARSH AURORA**, Montreal (CA); **YIQUN GE**, Kanata (CA)

(73) Assignee: **HUAWEI TECHNOLOGIES CO., LTD.**, SHENZHEN (CN)

(21) Appl. No.: **17/886,864**

(22) Filed: **Aug. 12, 2022**

Related U.S. Application Data

(63) Continuation of application No. 16/825,319, filed on Mar. 20, 2020, now Pat. No. 11,418,220.

Publication Classification

(51) **Int. Cl.**

H03M 13/29	(2006.01)
H04L 1/00	(2006.01)
H03M 13/27	(2006.01)
H03M 13/13	(2006.01)

(52) **U.S. Cl.**

CPC ***H03M 13/2933*** (2013.01); ***H04L 1/0059*** (2013.01); ***H04L 1/0071*** (2013.01); ***H03M 13/2792*** (2013.01); ***H04L 1/0042*** (2013.01); ***H03M 13/13*** (2013.01); ***H04L 1/0047*** (2013.01)

(57) **ABSTRACT**

A codeword is generated based on a segmentation transform and a Polarization-Assisted Convolutional (PAC) code that includes an outer convolutional code and a polar code, and based on separate encoding of respective different segments of convolutionally encoded input bits according to the polar code. Each segment of the respective segments includes multiple bits of the convolutionally encoded input bits for which the separate encoding of the segment is independent of the separate encoding of other segments. Separate decoding may be applied to segments of such a codeword to decode convolutionally encoded input bits corresponding to the separately encoded segments of the convolutionally encoded input bits.

100

$$G_2 = \begin{bmatrix} 1 & 0 \\ 1 & 1 \end{bmatrix} \quad G_2^{\otimes 2} = \begin{bmatrix} G_2 & 0 \\ G_2 & G_2 \end{bmatrix} \quad G_2^{\otimes 3} = \begin{bmatrix} G_2 & 0 & 0 & 0 \\ G_2 & G_2 & 0 & 0 \\ G_2 & 0 & G_2 & 0 \\ G_2 & G_2 & G_2 & G_2 \end{bmatrix}$$

$$G_2^{\otimes 2} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 \end{bmatrix}$$

102

$$G_2^{\otimes 3} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 & 0 & 0 & 0 & 0 \\ 1 & 1 & 1 & 1 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & 1 & 0 & 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 1 & 1 & 1 & 1 & 1 \end{bmatrix}$$

104