Postamble sequence design for supporting relay zone synchronization

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Changyoon Oh, Youngbin Chang,Hyoung Kyu Lim, Jungje Son, Jaeweon Cho, Panyuh Joo

Samsung Electronics Co., Ltd.
416 Maetan-3, Suwon, 442-600, Korea
Voice: +82-31-279-5519
Fax: +82-31-279-5130
E-mail: yb.chang@samsung.com

Rakesh Taori
Samsung Advanced Institute of Technology
C.P.O. Box 1142, Seoul, 100-611, Korea

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Purpose:

This contribution proposes a simple method of deriving postamble sequences using the existing preamble sequences and a PN sequence from PRBS defined in currnet 16e specification.

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Youngbin Chang, Changyoon Oh, Hyoungkyu Lim, Jaeweon Cho, Jungje Son, Panyuh Joo

Samsung Electronics

Rakesh Taori

Samsung Advanced Institute of Technology

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Motivation & Design consideration

- The preamble sequence can not applied in both access zone and relay zone
  - It may cause malfunctioning in the legacy MSs as they may start detecting a dual correlation peak within the duration of a single frame.
- The amble in relay zone can be generated from simple exclusive OR operation with two existing PN sequence in 16d/e not introducing band-new sequence

Two PN sequences in 16d/e

1. Preamble sequences are PN sequences defined in 8.4.6.1.1
   - Table 309, 309a, 309b and 309c for FFT sizes of 2048, 1024, 512, 128.respectively.
2. PN Sequence from PRBS generator defined in 8.4.9.4.1

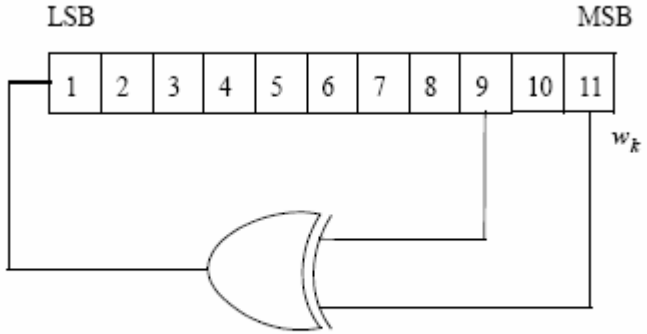

Figure 262—PRBS generator for pilot modulation

- b0…b4 = Five least significant bits of IDcell
- b5…b6 = Set to the segment number + 1
- b7…b10 =0b1111 (all ones) in the downlink

Postamble Sequence Generation

- The new PN sequence is generated by exclusive OR operation with two PN sequence $P_j = W_j \oplus w_j$
  - When W_j is a one of preamble sequences, w_j is PN sequence from PRBS, which has a same sequence length with W_j. Postamble sequence P_j can be generated by exclusive OR bit operation with two sequence

An example of Postamble Sequence

Sequence	Series
W_o	0xC12B7F736CFFB14B6ABF4EB50A60B7A3B4163EA3360F697C45075997ACE17BB1512C7C0CEBB34B389D8784553C0FC60BDE4F166CF7B04856442D97539FB915D80820CEDD858483
w_o	0xF40482D132BF08653E38DB76D5B06E3ADA365DE54E0EC6BB8AB40C87D313EB88B54C0F8633DF94389B5EC4BACA3C59A7E70F665FE40E86939BBEA881508251629D1D2D333FF803
P_o	0x352FFDA25E40B92E548795C3DFD0D9996E2063467801AFC7CFB355107FF29039E460738AD86CDF0006D940EFF6339FAC3940703313BECEC5DF933FD2CF3B44BA953DE3EEBA7C80

Correlation Performance

- A normalized correlation value are described in the table, when auto-correlation value is “1”

	Preamble(W_0)	Postamble(P_0)
Max cross correlation value with other preamble (W_0, W_1,…,W_{113})	0.09 (except W_0)	0.09
Max cross correlation value with other postamble (P_0, P_1,…, P_{113})	0.09	0.13 (except P_0)

PAPR Reduction of Postamble

- Some tones may be changed for PAPR reduction. This table shows the one example applying 10% tones (56 tones) are used for PAPR.

Sequence	Sequence series	PAPR
W_o	0xC12B7F736CFFB14B6ABF4EB50A60B7A3B4163EA3360F697C45075997ACE17BB1512C7C0CEBB34B389D8784553C0FC60BDE4F166CF7B04856442D97539FB915D80820CEDD858483	4.33
P_o	0x352FFDA25E40B92E548795C3DFD0D9996E2063467801AFC7CFB355107FF29039E460738AD86CDF0006D940EFF6339FAC3940703313BECEC5DF933FD2CF3B44BA953DE3EEBA7C80	9.34
P'_o	0x252BFDA21E50BD2E548785C7DED099996A2163467801AEC7CFB351107FB2803DE560339ADC6CDF4016DD41EFB6339BAC3940703312BE8ED5DB923FD2DF3F44BA953DE3EEBA3C80	6.47

Correlation Performance with PAPR reduction

- Auto-correlation performance not knowing the number of location of reserved tones for PAPR may be decrease, but is the number of tones is not too many, the performance is slightly decrease.
- When the number and location of reserved tones is informed to receiver, More correlation performance may be achieve.

	Postamble(P'_0)
Max cross correlation value with other postamble with PAPR reduction (P'_1, P'_2,…,P'_{113})	0.11 (except P'_0)
Correlation value with not knowing the location of reserved tones (P_0)	0.91

Proposed text

- *[Insert the followings after the end of section 8.4.6.1.1.2:]*

  8.4.6.1.1.3. Postamble sequence for downlink relay zone

  The text is described in 80216j-07/141r1 in on-site server

- *[Add parameter in table 358]*

  Table 359 – DCD channel encoding

Name	Type	Length	Value	Scope
Reservation bits for PAPR Reduction	XX	3	Bits:#0-7bits: the number of reserved tones Bits:#8-15bits: “A” (in Ak+B) Bits#16-23bits: “B” (in Ak+B)	OFDMA

Appendix

- Postamble sequence with 10% tones are reserved for PAPR

Index	Sequence series	PAPR
0	0x252BFDA21E50BD2E548785C7DED099996A2163467801AEC7CFB351107FB2803DE560339ADC6CDF4016DD41EFB6 339BAC3940703312BE8ED5DB923FD2DF3F44BA953DE3EEBA3C80	6.47
1	0x5DF36ECAE21AB50C6302075F446C5117FE896B476D487E70B9B60E4A614ED2A5F455A540453CA491A2F7D3C80A3 ADF6E410D29189B105C1DCD8FBE75878CAF5C997358C634AF7E	5.99
2	0xA2569D6AA5BC372A480AACCC2548F9A59F8FEC640DEB8FF4E1B251941EF3B8FCD8EA2A9B504D7B45B7A3CE5A 5E6BBC1E6011BCBD02CE3EDF5DC55346FD656D9936B9C422AECE79	5.99
3	0x47937783EC0D3909FFA4047B8CD722EC6CE5DF8F719EF51F82419E32B3728DC7B81051B64B60724B42611BF84B451 58D7D50A986E483D90E74855AD77875786A0E194587D9813F	6.55
4	0xEBD04A9A70646218FB07B70C5BD25401CCEEBFE185AB8021179228EC5C3A91D627599B8053545E332A0132F04F89 7CBBBBD0C2172B4A143CA071AE29B87DC94D9BFF6BC2DF846B	6.38
5	0xAA0017AA558DB8F6B7976F8041AC26A1ECB4CE0D7B478E8E18334C91DAD51B6CF37049E1041ABE0733C8806D5 CB6AF0B024F5C9B96D57444C17423E25B2D1B452F9F09A9EA9E63	5.68
6	0xBD4869A8075E0590F8D55EEFEDF9807F2AA3AF0CB8698D4618F75FD0A3CE1D44F4916839DE614F461B31FBB258A D99D33F23FBCC0D4DA243AAC7A6A6BA1EBFC99364B0D2DA41C8	5.90
…	…	
110	0904D15A3B86E0377A06537F7E862EC58A90FD5375BD2DD27C11A28C057D1A1DB24035B20DB153B168C3C377C28D 10BA3C3318AA9E04B7BF11F368214DD7E92F3DCBBC2D734298	6.29
111	83FCCCA2B27958271BF2B7F5ECD17EE1A45F8A9BD2480C72C5D2EE52E169CEECF1AC6E859BFE7544B780631B1B67 3D39370AA39E9D0A495AF33ACB361587CF3DA22B258357B3B8	5.98
112	7EE40E7C2C6757BD70C3F1CF2ED985C3782FE452079FBF7948D27F70542AD55664177DA1F5AF22C1F897B4537F1A6B 706A1769EB912D25AB53C9581C9C7F613B8329226A72EF49	5.99
113	83583387977FB5CDC06728B96CABA98647DCAC5DFD78EBBD43C781A4FF7B506B04C604164D2805B50E4FD6262F13 5D105CCCFB81F42064DE83A84285663B6C8A9BC752F919C9F5	5.45