Data Whitening and Random TX Mode

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Keywords

- *CC430*
- *CC1100*
- *CC1100E*
- *CC1101*
- *CC1110*
- *CC1111*
- *CC1150*
- *CC2500*
- *CC2510*
- *CC2511*
- *CC2550*
- *Whitening*
- *Test Generator*

1 Introduction

This document gives an overview of the data whitening and random data transmission circuitry in the CC430, CC1100, CC1100E, CC1101, CC1110, CC1111, CC1150, CC2500, CC2510, CC2511, and CC2550 devices.

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2 Abbreviations

CRC	Cyclic Redundancy Code
DC	Direct Current
LSB	Least Significant Bit
MSB	Most Significant Bit
RF	Radio Frequency
TX	Transmit, Transmit Mode
XOR	Exclusive OR logic operation

3 Data Whitening Circuitry

Radio operation is optimized when the data bits being transmitted are random and DC-free, not only because this gives a smooth power distribution over the occupied RF bandwidth, but also because random and DC-free data prevents the possibility of data dependencies in the receiver control loops. Many times, however, the data to be transmitted contains long strings of zeroes and ones. Performance can be improved by whitening the data before transmission. Whitening the data before transmission requires that the receiver undo the whitening before outputting the received data. The whitening and "de-whitening" operations can be automatically done by setting `PKTCTRL0.WHITE_DATA=1` in the transmitter and receiver, which whitens all data except the preamble and sync word in the transmitted packet.

Note that for the CC25xx devices that, in addition to their standard CRC, allow CC2400-compatible CRC to be generated, it is necessary that `PKTCTRL0.CC2400_EN= 0` (that is, the CRC be CC25xx-compatible, not CC2400-compatible) for the whitening operation to work properly.

The method to whiten the data is to exclusive-or (XOR) the user data with a pseudo-random sequence before transmission. When the data is received, it is XOR'd with the same sequence, which results in the original user data. The whitening circuitry is shown in Figure 1.

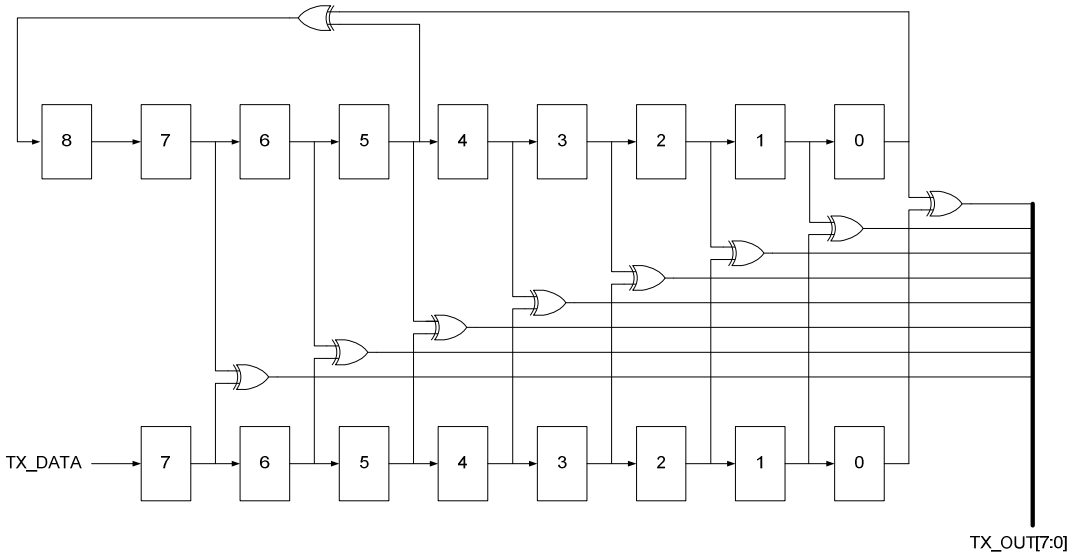

Figure 1. Data Whitening Circuitry

3.1 PN9 Generator

The 9-bit pseudo-random number ("PN9") generator is shown in the top of Figure 1. The generator is described by the polynomial $x^9 + x^5 + x^0$. The PN9 generates all the values between 1 through 511 (inclusively) in a pseudo-random order as it is clocked. The latches are all set to ones at the start of a whitening operation.

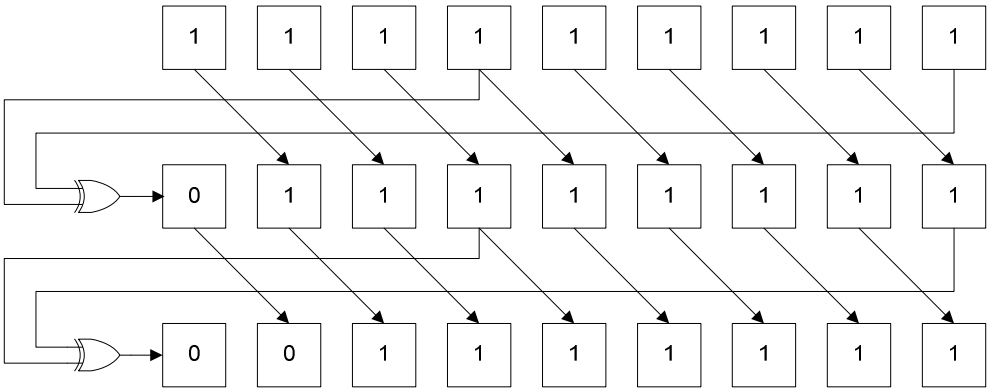

Figure 2. Operation of PN9 Generator

Figure 2. illustrates the operation of the PN9 generator as it is clocked. The generator starts with a value of all ones ('111111111'). Bit 0 (the LSB) and bit 5 are XOR'd to produce a zero that is shifted into the MSB on the next clock. This results in the next value of the generator being '011111111'. Again, bits 0 and 5 are XOR'd again to give the next value of the MSB (again, zero) to produce the next value of the generator ('001111111'), and the process continues through all 511 states of the generator. All 511 states are listed in Section 6.

3.2 Whitening Operation

The lower set of latches in Figure 1 contains the current byte of the data to be whitened. Recall that the preamble and sync words are not whitened, so the first byte of data to be whitened is either the packet length byte (in variable packet mode) or the first byte of user data.

When the first byte of data is ready, it is XOR'd with the eight LSBs of the initial value of the PN9 generator, which is all ones. So, the PN9 generator is '111111111', and the data is XOR'd with the eight LSBs of this, which is '11111111'. This whitened data is then transmitted over the air.

Next, the second byte of data is shifted into the data latches (eight shifts, one per bit) while the PN9 generator is also clocked eight times (once per bit). This means that the second byte of user data is not XOR'd with the next PN9 value, but instead by the value eight later in the PN9 sequence. Thus, the PN9 generator contains '111111111' when the first byte is processed, while the PN9 generator state during the second byte of data is not '011111111' (the next PN9 value), but instead '111100111' (the ninth PN9 value).

Section 6 lists the values that are XOR'd with the data when the value used is clocked eight times between each use.

3.3 Example

Suppose the (un-whitened) data sequence to be transmitted starts out as (these would be the bytes, for example, if a packet with a packet length byte of ten were transmitted, and the data were 0x00, 0x01, …):

/ 0000 1010 / 0000 0000 / 0000 0001 / 0000 0010 / …

Remember that the values to XOR with the data are the 8 LSBs of the PN9 sequence, if every eighth value is used:

1,1,1,1,1,1,1,1,1*** Eight LSBs are 1111 1111
0,1,1,1,1,1,1,1,1
0,0,1,1,1,1,1,1,1
0,0,0,1,1,1,1,1,1
0,0,0,0,1,1,1,1,1
1,0,0,0,0,1,1,1,1
1,1,0,0,0,0,1,1,1

1,1,1,0,0,0,0,1,1
1,1,1,1,0,0,0,0,1*** Eight LSBs are 1110 0001
0,1,1,1,1,0,0,0,0
1,0,1,1,1,1,0,0,0
1,1,0,1,1,1,1,0,0
1,1,1,0,1,1,1,1,0
0,1,1,1,0,1,1,1,1
0,0,1,1,1,0,1,1,1
0,0,0,1,1,1,0,1,1
0,0,0,0,1,1,1,0,1*** Eight LSBs are 0001 1101
1,0,0,0,0,1,1,1,0
0,1,0,0,0,0,1,1,1
1,0,1,0,0,0,0,1,1
1,1,0,1,0,0,0,0,1
0,1,1,0,1,0,0,0,0
0,0,1,1,0,1,0,0,0
1,0,0,1,1,0,1,0,0
1,1,0,0,1,1,0,1,0*** Eight LSBs are 10011010
0,1,1,0,0,1,1,0,1

So, the values to XOR with the data are:

/ 1111 1111 / 1110 0001 / 0001 1101 / 1001 1010/

Taking the exclusive-OR of these two sequences gives the data to be transmitted:

Data: / 0000 1010 / 0000 0000 / 0000 0001 / 0000 0010 / …
PN9: / 1111 1111 / 1110 0001 / 0001 1101 / 1001 1010/ …
Result: / 1111 0101 / 1110 0001 / 0001 1100 / 1001 1000 /…

When received, the resultant data is XOR'd with the same PN9-derived sequence, giving the originally transmitted data.

Received: / 1111 0101 / 1110 0001 / 0001 1100 / 1001 1000 /…
PN9: / 1111 1111 / 1110 0001 / 0001 1101 / 1001 1010/ …
Data: / 0000 1010 / 0000 0000 / 0000 0001 / 0000 0010 / …

4 Random TX Generator

The CC430, CC1100, CC1100E, CC1101, CC1110, CC1111, CC1150, CC2500, CC2510, C2511, and CC2550 devices also have the capability to generate a pseudo-random sequence continuously for test purposes. Random data generation is enabled by setting `PKTCTRL0.PKT_FORMAT(1:0)=10b`.

The random data is generated by the data whitening circuitry in Figure 1 with the latches at the bottom of the figure reset and held to zeroes. As with the data whitener, the PN9 generator is clocked eight times between each byte transmitted, and its eight LSBs are transmitted as data before it is clocked eight times again.

Thus, the data sequence transmitted is 0xFFE11D9A…; the complete sequence is shown here, where the hexadecimal bytes in the right-hand column are the eight LSBs of the PN9 sequence, using every eighth value of the pseudo-random sequence. Note that the length of the sequence is 4088 (=511×8) bits – 511 from the length of the PN9 generator, and 8 from the number of bits that are shifted out each time the PN9 generator is updated. (Table 1 is the same as the one in Section 6 with the sequence numbers arranged sequentially.)

Seq#	8	7	6	5	4	3	2	1	0	Output
1	1	1	1	1	1	1	1	1	1	FF
2	1	1	1	1	0	0	0	0	1	E1
3	0	0	0	0	1	1	1	0	1	1D
4	1	1	0	0	1	1	0	1	0	9A
5	1	1	1	1	0	1	1	0	1	ED
6	1	1	0	0	0	0	1	0	1	85
7	0	0	0	1	1	0	0	1	1	33
8	0	0	0	1	0	0	1	0	0	24
9	0	1	1	1	0	1	0	1	0	EA
10	0	0	1	1	1	1	0	1	0	7A
11	1	1	1	0	1	0	0	1	0	D2
12	0	0	0	1	1	1	0	0	1	39
13	1	0	1	1	1	0	0	0	0	70
14	1	1	0	0	1	0	1	1	1	97
15	0	0	1	0	1	0	1	1	1	57
16	0	0	0	0	0	1	0	1	0	0A
17	1	0	1	0	1	0	1	0	0	54
18	1	0	1	1	1	1	1	0	1	7D
19	0	0	0	1	0	1	1	0	1	2D
20	1	1	1	0	1	1	0	0	0	D8
21	1	0	1	1	0	1	1	0	1	6D
22	0	0	0	0	0	1	1	0	1	0D
23	1	1	0	1	1	1	0	1	0	BA
24	1	1	0	0	0	1	1	1	1	8F
25	1	0	1	1	0	0	1	1	1	67
26	1	0	1	0	1	1	0	0	1	59
27	0	1	1	0	0	0	1	1	1	C7
28	1	1	0	1	0	0	0	1	0	A2
29	0	1	0	1	1	1	1	1	1	BF
30	0	0	0	1	1	0	1	0	0	34
31	0	1	1	0	0	1	0	1	0	CA
32	0	0	0	0	1	1	0	0	0	18
33	1	0	0	1	1	0	0	0	0	30
34	1	0	1	0	1	0	0	1	1	53
35	1	1	0	0	1	0	0	1	1	93
36	0	1	1	0	1	1	1	1	1	DF
37	0	1	0	0	1	0	0	1	0	92
38	1	1	1	1	0	1	1	0	0	EC
39	1	1	0	1	0	0	1	1	1	A7
40	0	0	0	0	1	0	1	0	1	15

41	0	1	0	0	0	1	0	1	0	8A
42	0	1	1	0	1	1	1	0	0	DC
43	0	1	1	1	1	0	1	0	0	F4
44	1	1	0	0	0	0	1	1	0	86
45	0	0	1	0	1	0	1	0	1	55
46	0	0	1	0	0	1	1	1	0	4E
47	1	0	0	0	1	1	0	0	0	18
48	0	0	0	1	0	0	0	0	1	21
49	0	0	1	0	0	0	0	0	0	40
50	0	1	1	0	0	0	1	0	0	C4
51	1	1	1	0	0	0	1	0	0	C4
52	0	1	1	0	1	0	1	0	1	D5
53	1	1	1	0	0	0	1	1	0	C6
54	0	1	0	0	1	0	0	0	1	91
55	1	1	0	0	0	1	0	1	0	8A
56	1	1	1	0	0	1	1	0	1	CD
57	1	1	1	1	0	0	1	1	1	E7
58	0	1	1	0	1	0	0	0	1	D1
59	1	0	1	0	0	1	1	1	0	4E
60	0	0	0	0	0	1	0	0	1	09
61	1	0	0	1	1	0	0	1	0	32
62	1	0	0	0	1	0	1	1	1	17
63	1	1	1	0	1	1	1	1	1	DF
64	1	1	0	0	0	0	0	1	1	83
65	0	1	1	1	1	1	1	1	1	FF
66	0	1	1	1	1	0	0	0	0	F0
67	1	0	0	0	0	1	1	1	0	0E
68	0	1	1	0	0	1	1	0	1	CD
69	0	1	1	1	1	0	1	1	0	F6
70	1	1	1	0	0	0	0	1	0	C2
71	0	0	0	0	1	1	0	0	1	19
72	1	0	0	0	1	0	0	1	0	12
73	1	0	1	1	1	0	1	0	1	75
74	1	0	0	1	1	1	1	0	1	3D
75	0	1	1	1	0	1	0	0	1	E9
76	0	0	0	0	1	1	1	0	0	1C
77	1	1	0	1	1	1	0	0	0	B8
78	1	1	1	0	0	1	0	1	1	CB
79	1	0	0	1	0	1	0	1	1	2B
80	0	0	0	0	0	0	1	0	1	05
81	0	1	0	1	0	1	0	1	0	AA
82	0	1	0	1	1	1	1	1	0	BE

83	0	0	0	0	1	0	1	1	0	16
84	0	1	1	1	0	1	1	0	0	EC
85	0	1	0	1	1	0	1	1	0	B6
86	1	0	0	0	0	0	1	1	0	06
87	1	1	1	0	1	1	1	0	1	DD
88	1	1	1	0	0	0	1	1	1	C7
89	0	1	0	1	1	0	0	1	1	B3
90	1	1	0	1	0	1	1	0	0	AC
91	1	0	1	1	0	0	0	1	1	63
92	1	1	1	0	1	0	0	0	1	D1
93	0	0	1	0	1	1	1	1	1	5F
94	1	0	0	0	1	1	0	1	0	1A
95	0	0	1	1	0	0	1	0	1	65
96	0	0	0	0	0	1	1	0	0	0C
97	1	1	0	0	1	1	0	0	0	98
98	1	1	0	1	0	1	0	0	1	A9
99	1	1	1	0	0	1	0	0	1	C9
100	1	0	1	1	0	1	1	1	1	6F
101	0	0	1	0	0	1	0	0	1	49
102	1	1	1	1	1	0	1	1	0	F6
103	0	1	1	0	1	0	0	1	1	D3
104	1	0	0	0	0	1	0	1	0	0A
105	0	0	1	0	0	0	1	0	1	45
106	0	0	1	1	0	1	1	1	0	6E
107	1	0	1	1	1	1	0	1	0	7A
108	0	1	1	0	0	0	0	1	1	C3
109	1	0	0	1	0	1	0	1	0	2A
110	0	0	0	1	0	0	1	1	1	27
111	0	1	0	0	0	1	1	0	0	8C
112	0	0	0	0	1	0	0	0	0	10
113	0	0	0	1	0	0	0	0	0	20
114	0	0	1	1	0	0	0	1	0	62
115	0	1	1	1	0	0	0	1	0	E2
116	1	0	1	1	0	1	0	1	0	6A
117	0	1	1	1	0	0	0	1	1	E3
118	1	0	1	0	0	1	0	0	0	48
119	0	1	1	0	0	0	1	0	1	C5
120	1	1	1	1	0	0	1	1	0	E6
121	0	1	1	1	1	0	0	1	1	F3
122	1	0	1	1	0	1	0	0	0	68
123	0	1	0	1	0	0	1	1	1	A7
124	1	0	0	0	0	0	1	0	0	04

125	1	1	0	0	1	1	0	0	1	99
126	1	1	0	0	0	1	0	1	1	8B
127	1	1	1	1	0	1	1	1	1	EF
128	1	1	1	0	0	0	0	0	1	C1
129	0	0	1	1	1	1	1	1	1	7F
130	1	0	1	1	1	1	0	0	0	78
131	0	1	0	0	0	0	1	1	1	87
132	1	0	1	1	0	0	1	1	0	66
133	1	0	1	1	1	1	0	1	1	7B
134	0	1	1	1	0	0	0	0	1	E1
135	1	0	0	0	0	1	1	0	0	0C
136	0	1	0	0	0	1	0	0	1	89
137	0	1	0	1	1	1	0	1	0	BA
138	0	1	0	0	1	1	1	1	0	9E
139	0	0	1	1	1	0	1	0	0	74
140	0	0	0	0	0	1	1	1	0	0E
141	1	1	1	0	1	1	1	0	0	DC
142	1	1	1	1	0	0	1	0	1	E5
143	0	1	0	0	1	0	1	0	1	95
144	1	0	0	0	0	0	0	1	0	02
145	1	0	1	0	1	0	1	0	1	55
146	1	0	1	0	1	1	1	1	1	5F
147	0	0	0	0	0	1	0	1	1	0B
148	1	0	1	1	1	0	1	1	0	76
149	1	0	1	0	1	1	0	1	1	5B
150	0	1	0	0	0	0	0	1	1	83
151	1	1	1	1	0	1	1	1	0	EE
152	1	1	1	1	0	0	0	1	1	E3
153	0	0	1	0	1	1	0	0	1	59
154	1	1	1	0	1	0	1	1	0	D6
155	0	1	0	1	1	0	0	0	1	B1
156	1	1	1	1	0	1	0	0	0	E8
157	1	0	0	1	0	1	1	1	1	2F
158	0	1	0	0	0	1	1	0	1	8D
159	0	0	0	1	1	0	0	1	0	32
160	0	0	0	0	0	0	1	1	0	06
161	0	1	1	0	0	1	1	0	0	CC
162	0	1	1	0	1	0	1	0	0	D4
163	1	1	1	1	0	0	1	0	0	E4
164	0	1	0	1	1	0	1	1	1	B7
165	1	0	0	1	0	0	1	0	0	24
166	1	1	1	1	1	1	0	1	1	FB

167	1	0	1	1	0	1	0	0	1	69
168	0	1	0	0	0	0	1	0	1	85
169	1	0	0	1	0	0	0	1	0	22
170	1	0	0	1	1	0	1	1	1	37
171	1	1	0	1	1	1	1	0	1	BD
172	1	0	1	1	0	0	0	0	1	61
173	1	1	0	0	1	0	1	0	1	95
174	0	0	0	0	1	0	0	1	1	13
175	0	0	1	0	0	0	1	1	0	46
176	0	0	0	0	0	1	0	0	0	08
177	1	0	0	0	1	0	0	0	0	10
178	1	0	0	1	1	0	0	0	1	31
179	1	0	1	1	1	0	0	0	1	71
180	1	1	0	1	1	0	1	0	1	B5
181	0	0	1	1	1	0	0	0	1	71
182	0	1	0	1	0	0	1	0	0	A4
183	1	0	1	1	0	0	0	1	0	62
184	1	1	1	1	1	0	0	1	1	F3
185	0	0	1	1	1	1	0	0	1	79
186	1	1	0	1	1	0	1	0	0	B4
187	0	0	1	0	1	0	0	1	1	53
188	0	1	0	0	0	0	0	1	0	82
189	1	1	1	0	0	1	1	0	0	CC
190	1	1	1	0	0	0	1	0	1	C5
191	0	1	1	1	1	0	1	1	1	F7
192	1	1	1	1	0	0	0	0	0	E0
193	0	0	0	1	1	1	1	1	1	3F
194	1	1	0	1	1	1	1	0	0	BC
195	1	0	1	0	0	0	0	1	1	43
196	1	1	0	1	1	0	0	1	1	B3
197	0	1	0	1	1	1	1	0	1	BD
198	0	0	1	1	1	0	0	0	0	70
199	0	1	0	0	0	0	1	1	0	86
200	1	0	1	0	0	0	1	0	0	44
201	1	0	1	0	1	1	1	0	1	5D
202	0	0	1	0	0	1	1	1	1	4F
203	1	0	0	1	1	1	0	1	0	3A
204	0	0	0	0	0	0	1	1	1	07
205	0	1	1	1	0	1	1	1	0	EE
206	0	1	1	1	1	0	0	1	0	F2
207	1	0	1	0	0	1	0	1	0	4A
208	0	1	0	0	0	0	0	0	1	81

209	1	1	0	1	0	1	0	1	0	AA
210	1	1	0	1	0	1	1	1	1	AF
211	1	0	0	0	0	0	1	0	1	05
212	1	1	0	1	1	1	0	1	1	BB
213	1	1	0	1	0	1	1	0	1	AD
214	1	0	1	0	0	0	0	0	1	41
215	1	1	1	1	1	0	1	1	1	F7
216	0	1	1	1	1	0	0	0	1	F1
217	1	0	0	1	0	1	1	0	0	2C
218	0	1	1	1	0	1	0	1	1	EB
219	0	0	1	0	1	1	0	0	0	58
220	1	1	1	1	1	0	1	0	0	F4
221	0	1	0	0	1	0	1	1	1	97
222	1	0	1	0	0	0	1	1	0	46
223	1	0	0	0	1	1	0	0	1	19
224	0	0	0	0	0	0	0	1	1	03
225	0	0	1	1	0	0	1	1	0	66
226	0	0	1	1	0	1	0	1	0	6A
227	1	1	1	1	1	0	0	1	0	F2
228	0	0	1	0	1	1	0	1	1	5B
229	1	1	0	0	1	0	0	1	0	92
230	0	1	1	1	1	1	1	0	1	FD
231	0	1	0	1	1	0	1	0	0	B4
232	1	0	1	0	0	0	0	1	0	42
233	1	1	0	0	1	0	0	0	1	91
234	0	1	0	0	1	1	0	1	1	9B
235	0	1	1	0	1	1	1	1	0	DE
236	0	1	0	1	1	0	0	0	0	B0
237	1	1	1	0	0	1	0	1	0	CA
238	1	0	0	0	0	1	0	0	1	09
239	0	0	0	1	0	0	0	1	1	23
240	0	0	0	0	0	0	1	0	0	04
241	0	1	0	0	0	1	0	0	0	88
242	0	1	0	0	1	1	0	0	0	98
243	0	1	0	1	1	1	0	0	0	B8
244	0	1	1	0	1	1	0	1	0	DA
245	0	0	0	1	1	1	0	0	0	38
246	1	0	1	0	1	0	0	1	0	52
247	1	1	0	1	1	0	0	0	1	B1
248	0	1	1	1	1	1	0	0	1	F9
249	0	0	0	1	1	1	1	0	0	3C
250	1	1	1	0	1	1	0	1	0	DA

251	1	0	0	1	0	1	0	0	1	29
252	0	0	1	0	0	0	0	0	1	41
253	0	1	1	1	0	0	1	1	0	E6
254	1	1	1	1	0	0	0	1	0	E2
255	0	0	1	1	1	1	0	1	1	7B
256	1	1	1	1	1	0	0	0	0	F0
257	0	0	0	0	1	1	1	1	1	1F
258	1	1	1	0	1	1	1	1	0	DE
259	1	1	0	1	0	0	0	0	1	A1
260	0	1	1	0	1	1	0	0	1	D9
261	0	0	1	0	1	1	1	1	0	5E
262	1	0	0	1	1	1	0	0	0	38
263	0	0	1	0	0	0	0	1	1	43
264	0	1	0	1	0	0	0	1	0	A2
265	1	1	0	1	0	1	1	1	0	AE
266	1	0	0	1	0	0	1	1	1	27
267	1	1	0	0	1	1	1	0	1	9D
268	1	0	0	0	0	0	0	1	1	03
269	1	0	1	1	1	0	1	1	1	77
270	1	0	1	1	1	1	0	0	1	79
271	0	1	0	1	0	0	1	0	1	A5
272	1	0	1	0	0	0	0	0	0	40
273	1	1	1	0	1	0	1	0	1	D5
274	0	1	1	0	1	0	1	1	1	D7
275	1	1	0	0	0	0	0	1	0	82
276	0	1	1	0	1	1	1	0	1	DD
277	0	1	1	0	1	0	1	1	0	D6
278	1	1	0	1	0	0	0	0	0	A0
279	0	1	1	1	1	1	0	1	1	FB
280	0	0	1	1	1	1	0	0	0	78
281	1	1	0	0	1	0	1	1	0	96
282	0	0	1	1	1	0	1	0	1	75
283	0	0	0	1	0	1	1	0	0	2C
284	1	1	1	1	1	1	0	1	0	FA
285	1	0	1	0	0	1	0	1	1	4B
286	0	1	0	1	0	0	0	1	1	A3
287	1	1	0	0	0	1	1	0	0	8C
288	1	0	0	0	0	0	0	0	1	01
289	1	0	0	1	1	0	0	1	1	33
290	1	0	0	1	1	0	1	0	1	35
291	1	1	1	1	1	1	0	0	1	F9
292	1	0	0	1	0	1	1	0	1	2D

293	0	1	1	0	0	1	0	0	1	C9
294	0	0	1	1	1	1	1	1	0	7E
295	1	0	1	0	1	1	0	1	0	5A
296	0	1	0	1	0	0	0	0	1	A1
297	1	1	1	0	0	1	0	0	0	C8
298	1	0	1	0	0	1	1	0	1	4D
299	0	0	1	1	0	1	1	1	1	6F
300	1	0	1	0	1	1	0	0	0	58
301	0	1	1	1	0	0	1	0	1	E5
302	1	1	0	0	0	0	1	0	0	84
303	0	0	0	0	1	0	0	0	1	11
304	0	0	0	0	0	0	0	1	0	02
305	0	0	1	0	0	0	1	0	0	44
306	0	0	1	0	0	1	1	0	0	4C
307	1	0	1	0	1	1	1	0	0	5C
308	0	0	1	1	0	1	1	0	1	6D
309	1	0	0	0	1	1	1	0	0	1C
310	0	1	0	1	0	1	0	0	1	A9
311	0	1	1	0	1	1	0	0	0	D8
312	0	0	1	1	1	1	1	0	0	7C
313	1	0	0	0	1	1	1	1	0	1E
314	0	1	1	1	0	1	1	0	1	ED
315	0	1	0	0	1	0	1	0	0	94
316	1	0	0	1	0	0	0	0	0	20
317	1	0	1	1	1	0	0	1	1	73
318	1	1	1	1	1	0	0	0	1	F1
319	0	0	0	1	1	1	1	0	1	3D
320	1	1	1	1	1	1	0	0	0	F8
321	1	0	0	0	0	1	1	1	1	0F
322	0	1	1	1	0	1	1	1	1	EF
323	0	1	1	0	1	0	0	0	0	D0
324	1	0	1	1	0	1	1	0	0	6C
325	0	0	0	1	0	1	1	1	1	2F
326	1	1	0	0	1	1	1	0	0	9C
327	1	0	0	1	0	0	0	0	1	21
328	1	0	1	0	1	0	0	0	1	51
329	1	1	1	0	1	0	1	1	1	D7
330	0	1	0	0	1	0	0	1	1	93
331	1	1	1	0	0	1	1	1	0	CE
332	1	1	0	0	0	0	0	0	1	81
333	0	1	0	1	1	1	0	1	1	BB
334	0	1	0	1	1	1	1	0	0	BC

335	0	0	1	0	1	0	0	1	0	52
336	0	1	0	1	0	0	0	0	0	A0
337	1	1	1	1	0	1	0	1	0	EA
338	1	0	1	1	0	1	0	1	1	6B
339	0	1	1	0	0	0	0	0	1	C1
340	1	0	1	1	0	1	1	1	0	6E
341	0	0	1	1	0	1	0	1	1	6B
342	1	1	1	0	1	0	0	0	0	D0
343	0	0	1	1	1	1	1	0	1	7D
344	1	0	0	1	1	1	1	0	0	3C
345	0	1	1	0	0	1	0	1	1	CB
346	0	0	0	1	1	1	0	1	0	3A
347	1	0	0	0	1	0	1	1	0	16
348	1	1	1	1	1	1	1	0	1	FD
349	1	1	0	1	0	0	1	0	1	A5
350	0	0	1	0	1	0	0	0	1	51
351	0	1	1	0	0	0	1	1	0	C6
352	1	1	0	0	0	0	0	0	0	80
353	0	1	0	0	1	1	0	0	1	99
354	0	1	0	0	1	1	0	1	0	9A
355	0	1	1	1	1	1	1	0	0	FC
356	0	1	0	0	1	0	1	1	0	96
357	1	0	1	1	0	0	1	0	0	64
358	1	0	0	1	1	1	1	1	1	3F
359	0	1	0	1	0	1	1	0	1	AD
360	0	0	1	0	1	0	0	0	0	50
361	0	1	1	1	0	0	1	0	0	E4
362	1	1	0	1	0	0	1	1	0	A6
363	0	0	0	1	1	0	1	1	1	37
364	0	1	0	1	0	1	1	0	0	AC
365	0	0	1	1	1	0	0	1	0	72
366	0	1	1	0	0	0	0	1	0	C2
367	1	0	0	0	0	1	0	0	0	08
368	0	0	0	0	0	0	0	0	1	01
369	0	0	0	1	0	0	0	1	0	22
370	0	0	0	1	0	0	1	1	0	26
371	0	1	0	1	0	1	1	1	0	AE
372	0	0	0	1	1	0	1	1	0	36
373	0	1	0	0	0	1	1	1	0	8E
374	0	0	1	0	1	0	1	0	0	54
375	0	0	1	1	0	1	1	0	0	6C
376	1	0	0	1	1	1	1	1	0	3E

377	0	1	0	0	0	1	1	1	1	8F
378	0	0	1	1	1	0	1	1	0	76
379	0	0	1	0	0	1	0	1	0	4A
380	1	1	0	0	1	0	0	0	0	90
381	0	1	0	1	1	1	0	0	1	B9
382	0	1	1	1	1	1	0	0	0	F8
383	0	0	0	0	1	1	1	1	0	1E
384	1	1	1	1	1	1	1	0	0	FC
385	1	1	0	0	0	0	1	1	1	87
386	0	0	1	1	1	0	1	1	1	77
387	0	0	1	1	0	1	0	0	0	68
388	1	1	0	1	1	0	1	1	0	B6
389	0	0	0	0	1	0	1	1	1	17
390	0	1	1	0	0	1	1	1	0	CE
391	0	1	0	0	1	0	0	0	0	90
392	1	1	0	1	0	1	0	0	0	A8
393	1	1	1	1	0	1	0	1	1	EB
394	1	0	1	0	0	1	0	0	1	49
395	0	1	1	1	0	0	1	1	1	E7
396	1	1	1	0	0	0	0	0	0	C0
397	0	0	1	0	1	1	1	0	1	5D
398	1	0	1	0	1	1	1	1	0	5E
399	0	0	0	1	0	1	0	0	1	29
400	1	0	1	0	1	0	0	0	0	50
401	1	1	1	1	1	0	1	0	1	F5
402	0	1	0	1	1	0	1	0	1	B5
403	1	0	1	1	0	0	0	0	0	60
404	1	1	0	1	1	0	1	1	1	B7
405	0	0	0	1	1	0	1	0	1	35
406	0	1	1	1	0	1	0	0	0	E8
407	0	0	0	1	1	1	1	1	0	3E
408	1	1	0	0	1	1	1	1	0	9E
409	1	0	1	1	0	0	1	0	1	65
410	1	0	0	0	1	1	1	0	1	1D
411	0	1	0	0	0	1	0	1	1	8B
412	0	1	1	1	1	1	1	1	0	FE
413	0	1	1	0	1	0	0	1	0	D2
414	1	0	0	1	0	1	0	0	0	28
415	0	0	1	1	0	0	0	1	1	63
416	0	1	1	0	0	0	0	0	0	C0
417	1	0	1	0	0	1	1	0	0	4C
418	0	0	1	0	0	1	1	0	1	4D

419	1	0	1	1	1	1	1	1	0	7E
420	0	0	1	0	0	1	0	1	1	4B
421	1	1	0	1	1	0	0	1	0	B2
422	0	1	0	0	1	1	1	1	1	9F
423	0	0	1	0	1	0	1	1	0	56
424	0	0	0	1	0	1	0	0	0	28
425	1	0	1	1	1	0	0	1	0	72
426	1	1	1	0	1	0	0	1	1	D3
427	0	0	0	0	1	1	0	1	1	1B
428	1	0	1	0	1	0	1	1	0	56
429	1	0	0	1	1	1	0	0	1	39
430	0	0	1	1	0	0	0	0	1	61
431	0	1	0	0	0	0	1	0	0	84
432	1	0	0	0	0	0	0	0	0	00
433	1	0	0	0	1	0	0	0	1	11
434	1	0	0	0	1	0	0	1	1	13
435	1	0	1	0	1	0	1	1	1	57
436	1	0	0	0	1	1	0	1	1	1B
437	0	0	1	0	0	0	1	1	1	47
438	0	0	0	1	0	1	0	1	0	2A
439	1	0	0	1	1	0	1	1	0	36
440	1	1	0	0	1	1	1	1	1	9F
441	1	0	1	0	0	0	1	1	1	47
442	1	0	0	1	1	1	0	1	1	3B
443	0	0	0	1	0	0	1	0	1	25
444	0	1	1	0	0	1	0	0	0	C8
445	0	0	1	0	1	1	1	0	0	5C
446	1	0	1	1	1	1	1	0	0	7C
447	0	0	0	0	0	1	1	1	1	0F
448	1	1	1	1	1	1	1	1	0	FE
449	1	1	1	0	0	0	0	1	1	C3
450	0	0	0	1	1	1	0	1	1	3B
451	1	0	0	1	1	0	1	0	0	34
452	1	1	1	0	1	1	0	1	1	DB
453	1	0	0	0	0	1	0	1	1	0B
454	0	0	1	1	0	0	1	1	1	67
455	0	0	1	0	0	1	0	0	0	48
456	1	1	1	0	1	0	1	0	0	D4
457	0	1	1	1	1	0	1	0	1	F5
458	1	1	0	1	0	0	1	0	0	A4
459	0	0	1	1	1	0	0	1	1	73
460	0	1	1	1	0	0	0	0	0	E0

461	1	0	0	1	0	1	1	1	0	2E
462	0	1	0	1	0	1	1	1	1	AF
463	0	0	0	0	1	0	1	0	0	14
464	0	1	0	1	0	1	0	0	0	A8
465	0	1	1	1	1	1	0	1	0	FA
466	0	0	1	0	1	1	0	1	0	5A
467	1	1	0	1	1	0	0	0	0	B0
468	0	1	1	0	1	1	0	1	1	DB
469	0	0	0	0	1	1	0	1	0	1A
470	1	0	1	1	1	0	1	0	0	74
471	1	0	0	0	1	1	1	1	1	1F
472	0	1	1	0	0	1	1	1	1	CF
473	0	1	0	1	1	0	0	1	0	B2
474	1	1	0	0	0	1	1	1	0	8E
475	1	0	1	0	0	0	1	0	1	45
476	1	0	1	1	1	1	1	1	1	7F
477	0	0	1	1	0	1	0	0	1	69
478	1	1	0	0	1	0	1	0	0	94
479	0	0	0	1	1	0	0	0	1	31
480	0	0	1	1	0	0	0	0	0	60
481	0	1	0	1	0	0	1	1	0	A6
482	1	0	0	1	0	0	1	1	0	26
483	1	1	0	1	1	1	1	1	1	BF
484	1	0	0	1	0	0	1	0	1	25
485	1	1	1	0	1	1	0	0	1	D9
486	1	0	1	0	0	1	1	1	1	4F
487	0	0	0	1	0	1	0	1	1	2B
488	1	0	0	0	1	0	1	0	0	14
489	1	1	0	1	1	1	0	0	1	B9
490	1	1	1	1	0	1	0	0	1	E9
491	1	0	0	0	0	1	1	0	1	0D
492	0	1	0	1	0	1	0	1	1	AB
493	0	1	0	0	1	1	1	0	0	9C
494	0	0	0	1	1	0	0	0	0	30
495	0	0	1	0	0	0	0	1	0	42
496	0	1	0	0	0	0	0	0	0	80
497	1	1	0	0	0	1	0	0	0	88
498	1	1	0	0	0	1	0	0	1	89
499	1	1	0	1	0	1	0	1	1	AB
500	1	1	0	0	0	1	1	0	1	8D
501	1	0	0	1	0	0	0	1	1	23
502	1	0	0	0	1	0	1	0	1	15

503	1	1	0	0	1	1	0	1	1	9B
504	1	1	1	0	0	1	1	1	1	CF
505	1	1	0	1	0	0	0	1	1	A3
506	0	1	0	0	1	1	1	0	1	9D
507	0	0	0	0	1	0	0	1	0	12
508	0	0	1	1	0	0	1	0	0	64
509	0	0	0	1	0	1	1	1	0	2E
510	1	1	0	1	1	1	1	1	0	BE
511	1	0	0	0	0	0	1	1	1	07

Table 1. Bytes XOR'd with Data during a Whitening Operation

5 Summary

This document has described and illustrated the operation of the whitening and random TX generation hardware, which use the same circuitry for their operations.

6 Appendix – PN9 Information

Table 2 shows the sequential states of the PN9 generator. The index in the left-hand column of the table lists the order in which they are used in the hardware due to the PN9 generator being clocked eight times between each use. Thus, the PN9 values used are '111111111', '111100001', '000011101', etc.

Note that the eight LSBs of the generated sequence are the ones that are exclusive-OR'd with the data to be whitened. The hexadecimal representations of these are shown in the right hand column of this table.

Seq #	8	7	6	5	4	3	2	1	0	
1	1	1	1	1	1	1	1	1	1	FF
65	0	1	1	1	1	1	1	1	1	FF
129	0	0	1	1	1	1	1	1	1	7F
193	0	0	0	1	1	1	1	1	1	3F
257	0	0	0	0	1	1	1	1	1	1F
321	1	0	0	0	0	1	1	1	1	0F
385	1	1	0	0	0	0	1	1	1	87
449	1	1	1	0	0	0	0	1	1	C3
2	1	1	1	1	0	0	0	0	1	E1
66	0	1	1	1	1	0	0	0	0	F0
130	1	0	1	1	1	1	0	0	0	78
194	1	1	0	1	1	1	1	0	0	BC
258	1	1	1	0	1	1	1	1	0	DE
322	0	1	1	1	0	1	1	1	1	EF
386	0	0	1	1	1	0	1	1	1	77
450	0	0	0	1	1	1	0	1	1	3B
3	0	0	0	0	1	1	1	0	1	1D
67	1	0	0	0	0	1	1	1	0	0E
131	0	1	0	0	0	0	1	1	1	87
195	1	0	1	0	0	0	0	1	1	43
259	1	1	0	1	0	0	0	0	1	A1
323	0	1	1	0	1	0	0	0	0	D0
387	0	0	1	1	0	1	0	0	0	68
451	1	0	0	1	1	0	1	0	0	34
4	1	1	0	0	1	1	0	1	0	9A
68	0	1	1	0	0	1	1	0	1	CD
132	1	0	1	1	0	0	1	1	0	66
196	1	1	0	1	1	0	0	1	1	B3
260	0	1	1	0	1	1	0	0	1	D9
324	1	0	1	1	0	1	1	0	0	6C
388	1	1	0	1	1	0	1	1	0	B6
452	1	1	1	0	1	1	0	1	1	DB
5	1	1	1	1	0	1	1	0	1	ED
69	0	1	1	1	1	0	1	1	0	F6

133	1	0	1	1	1	1	0	1	1	7B
197	0	1	0	1	1	1	1	0	1	BD
261	0	0	1	0	1	1	1	1	0	5E
325	0	0	0	1	0	1	1	1	1	2F
389	0	0	0	0	1	0	1	1	1	17
453	1	0	0	0	0	1	0	1	1	0B
6	1	1	0	0	0	0	1	0	1	85
70	1	1	1	0	0	0	0	1	0	C2
134	0	1	1	1	0	0	0	0	1	E1
198	0	0	1	1	1	0	0	0	0	70
262	1	0	0	1	1	1	0	0	0	38
326	1	1	0	0	1	1	1	0	0	9C
390	0	1	1	0	0	1	1	1	0	CE
454	0	0	1	1	0	0	1	1	1	67
7	0	0	0	1	1	0	0	1	1	33
71	0	0	0	0	1	1	0	0	1	19
135	1	0	0	0	0	1	1	0	0	0C
199	0	1	0	0	0	0	1	1	0	86
263	0	0	1	0	0	0	0	1	1	43
327	1	0	0	1	0	0	0	0	1	21
391	0	1	0	0	1	0	0	0	0	90
455	0	0	1	0	0	1	0	0	0	48
8	0	0	0	1	0	0	1	0	0	24
72	1	0	0	0	1	0	0	1	0	12
136	0	1	0	0	0	1	0	0	1	89
200	1	0	1	0	0	0	1	0	0	44
264	0	1	0	1	0	0	0	1	0	A2
328	1	0	1	0	1	0	0	0	1	51
392	1	1	0	1	0	1	0	0	0	A8
456	1	1	1	0	1	0	1	0	0	D4
9	0	1	1	1	0	1	0	1	0	EA
73	1	0	1	1	1	0	1	0	1	75
137	0	1	0	1	1	1	0	1	0	BA
201	1	0	1	0	1	1	1	0	1	5D
265	1	1	0	1	0	1	1	1	0	AE
329	1	1	1	0	1	0	1	1	1	D7
393	1	1	1	1	0	1	0	1	1	EB
457	0	1	1	1	1	0	1	0	1	F5
10	0	0	1	1	1	1	0	1	0	7A
74	1	0	0	1	1	1	1	0	1	3D
138	0	1	0	0	1	1	1	1	0	9E
202	0	0	1	0	0	1	1	1	1	4F

266	1	0	0	1	0	0	1	1	1	27
330	0	1	0	0	1	0	0	1	1	93
394	1	0	1	0	0	1	0	0	1	49
458	1	1	0	1	0	0	1	0	0	A4
11	1	1	1	0	1	0	0	1	0	D2
75	0	1	1	1	0	1	0	0	1	E9
139	0	0	1	1	1	0	1	0	0	74
203	1	0	0	1	1	1	0	1	0	3A
267	1	1	0	0	1	1	1	0	1	9D
331	1	1	1	0	0	1	1	1	0	CE
395	0	1	1	1	0	0	1	1	1	E7
459	0	0	1	1	1	0	0	1	1	73
12	0	0	0	1	1	1	0	0	1	39
76	0	0	0	0	1	1	1	0	0	1C
140	0	0	0	0	0	1	1	1	0	0E
204	0	0	0	0	0	0	1	1	1	07
268	1	0	0	0	0	0	0	1	1	03
332	1	1	0	0	0	0	0	0	1	81
396	1	1	1	0	0	0	0	0	0	C0
460	0	1	1	1	0	0	0	0	0	E0
13	1	0	1	1	1	0	0	0	0	70
77	1	1	0	1	1	1	0	0	0	B8
141	1	1	1	0	1	1	1	0	0	DC
205	0	1	1	1	0	1	1	1	0	EE
269	1	0	1	1	1	0	1	1	1	77
333	0	1	0	1	1	1	0	1	1	BB
397	0	0	1	0	1	1	1	0	1	5D
461	1	0	0	1	0	1	1	1	0	2E
14	1	1	0	0	1	0	1	1	1	97
78	1	1	1	0	0	1	0	1	1	CB
142	1	1	1	1	0	0	1	0	1	E5
206	0	1	1	1	1	0	0	1	0	F2
270	1	0	1	1	1	1	0	0	1	79
334	0	1	0	1	1	1	1	0	0	BC
398	1	0	1	0	1	1	1	1	0	5E
462	0	1	0	1	0	1	1	1	1	AF
15	0	0	1	0	1	0	1	1	1	57
79	1	0	0	1	0	1	0	1	1	2B
143	0	1	0	0	1	0	1	0	1	95
207	1	0	1	0	0	1	0	1	0	4A
271	0	1	0	1	0	0	1	0	1	A5
335	0	0	1	0	1	0	0	1	0	52

399	0	0	0	1	0	1	0	0	1	29
463	0	0	0	0	1	0	1	0	0	14
16	0	0	0	0	0	1	0	1	0	0A
80	0	0	0	0	0	0	1	0	1	05
144	1	0	0	0	0	0	0	1	0	02
208	0	1	0	0	0	0	0	0	1	81
272	1	0	1	0	0	0	0	0	0	40
336	0	1	0	1	0	0	0	0	0	A0
400	1	0	1	0	1	0	0	0	0	50
464	0	1	0	1	0	1	0	0	0	A8
17	1	0	1	0	1	0	1	0	0	54
81	0	1	0	1	0	1	0	1	0	AA
145	1	0	1	0	1	0	1	0	1	55
209	1	1	0	1	0	1	0	1	0	AA
273	1	1	1	0	1	0	1	0	1	D5
337	1	1	1	1	0	1	0	1	0	EA
401	1	1	1	1	1	0	1	0	1	F5
465	0	1	1	1	1	1	0	1	0	FA
18	1	0	1	1	1	1	1	0	1	7D
82	0	1	0	1	1	1	1	1	0	BE
146	1	0	1	0	1	1	1	1	1	5F
210	1	1	0	1	0	1	1	1	1	AF
274	0	1	1	0	1	0	1	1	1	D7
338	1	0	1	1	0	1	0	1	1	6B
402	0	1	0	1	1	0	1	0	1	B5
466	0	0	1	0	1	1	0	1	0	5A
19	0	0	0	1	0	1	1	0	1	2D
83	0	0	0	0	1	0	1	1	0	16
147	0	0	0	0	0	1	0	1	1	0B
211	1	0	0	0	0	0	1	0	1	05
275	1	1	0	0	0	0	0	1	0	82
339	0	1	1	0	0	0	0	0	1	C1
403	1	0	1	1	0	0	0	0	0	60
467	1	1	0	1	1	0	0	0	0	B0
20	1	1	1	0	1	1	0	0	0	D8
84	0	1	1	1	0	1	1	0	0	EC
148	1	0	1	1	1	0	1	1	0	76
212	1	1	0	1	1	1	0	1	1	BB
276	0	1	1	0	1	1	1	0	1	DD
340	1	0	1	1	0	1	1	1	0	6E
404	1	1	0	1	1	0	1	1	1	B7
468	0	1	1	0	1	1	0	1	1	DB

21	1	0	1	1	0	1	1	0	1	6D
85	0	1	0	1	1	0	1	1	0	B6
149	1	0	1	0	1	1	0	1	1	5B
213	1	1	0	1	0	1	1	0	1	AD
277	0	1	1	0	1	0	1	1	0	D6
341	0	0	1	1	0	1	0	1	1	6B
405	0	0	0	1	1	0	1	0	1	35
469	0	0	0	0	1	1	0	1	0	1A
22	0	0	0	0	0	1	1	0	1	0D
86	1	0	0	0	0	0	1	1	0	06
150	0	1	0	0	0	0	0	1	1	83
214	1	0	1	0	0	0	0	0	1	41
278	1	1	0	1	0	0	0	0	0	A0
342	1	1	1	0	1	0	0	0	0	D0
406	0	1	1	1	0	1	0	0	0	E8
470	1	0	1	1	1	0	1	0	0	74
23	1	1	0	1	1	1	0	1	0	BA
87	1	1	1	0	1	1	1	0	1	DD
151	1	1	1	1	0	1	1	1	0	EE
215	1	1	1	1	1	0	1	1	1	F7
279	0	1	1	1	1	1	0	1	1	FB
343	0	0	1	1	1	1	1	0	1	7D
407	0	0	0	1	1	1	1	1	0	3E
471	1	0	0	0	1	1	1	1	1	1F
24	1	1	0	0	0	1	1	1	1	8F
88	1	1	1	0	0	0	1	1	1	C7
152	1	1	1	1	0	0	0	1	1	E3
216	0	1	1	1	1	0	0	0	1	F1
280	0	0	1	1	1	1	0	0	0	78
344	1	0	0	1	1	1	1	0	0	3C
408	1	1	0	0	1	1	1	1	0	9E
472	0	1	1	0	0	1	1	1	1	CF
25	1	0	1	1	0	0	1	1	1	67
89	0	1	0	1	1	0	0	1	1	B3
153	0	0	1	0	1	1	0	0	1	59
217	1	0	0	1	0	1	1	0	0	2C
281	1	1	0	0	1	0	1	1	0	96
345	0	1	1	0	0	1	0	1	1	CB
409	1	0	1	1	0	0	1	0	1	65
473	0	1	0	1	1	0	0	1	0	B2
26	1	0	1	0	1	1	0	0	1	59
90	1	1	0	1	0	1	1	0	0	AC

154	1	1	1	0	1	0	1	1	0	D6
218	0	1	1	1	0	1	0	1	1	EB
282	0	0	1	1	1	0	1	0	1	75
346	0	0	0	1	1	1	0	1	0	3A
410	1	0	0	0	1	1	1	0	1	1D
474	1	1	0	0	0	1	1	1	0	8E
27	0	1	1	0	0	0	1	1	1	C7
91	1	0	1	1	0	0	0	1	1	63
155	0	1	0	1	1	0	0	0	1	B1
219	0	0	1	0	1	1	0	0	0	58
283	0	0	0	1	0	1	1	0	0	2C
347	1	0	0	0	1	0	1	1	0	16
411	0	1	0	0	0	1	0	1	1	8B
475	1	0	1	0	0	0	1	0	1	45
28	1	1	0	1	0	0	0	1	0	A2
92	1	1	1	0	1	0	0	0	1	D1
156	1	1	1	1	0	1	0	0	0	E8
220	1	1	1	1	1	0	1	0	0	F4
284	1	1	1	1	1	1	0	1	0	FA
348	1	1	1	1	1	1	1	0	1	FD
412	0	1	1	1	1	1	1	1	0	FE
476	1	0	1	1	1	1	1	1	1	7F
29	0	1	0	1	1	1	1	1	1	BF
93	0	0	1	0	1	1	1	1	1	5F
157	1	0	0	1	0	1	1	1	1	2F
221	0	1	0	0	1	0	1	1	1	97
285	1	0	1	0	0	1	0	1	1	4B
349	1	1	0	1	0	0	1	0	1	A5
413	0	1	1	0	1	0	0	1	0	D2
477	0	0	1	1	0	1	0	0	1	69
30	0	0	0	1	1	0	1	0	0	34
94	1	0	0	0	1	1	0	1	0	1A
158	0	1	0	0	0	1	1	0	1	8D
222	1	0	1	0	0	0	1	1	0	46
286	0	1	0	1	0	0	0	1	1	A3
350	0	0	1	0	1	0	0	0	1	51
414	1	0	0	1	0	1	0	0	0	28
478	1	1	0	0	1	0	1	0	0	94
31	0	1	1	0	0	1	0	1	0	CA
95	0	0	1	1	0	0	1	0	1	65
159	0	0	0	1	1	0	0	1	0	32
223	1	0	0	0	1	1	0	0	1	19

287	1	1	0	0	0	1	1	0	0	8C
351	0	1	1	0	0	0	1	1	0	C6
415	0	0	1	1	0	0	0	1	1	63
479	0	0	0	1	1	0	0	0	1	31
32	0	0	0	0	1	1	0	0	0	18
96	0	0	0	0	0	1	1	0	0	0C
160	0	0	0	0	0	0	1	1	0	06
224	0	0	0	0	0	0	0	1	1	03
288	1	0	0	0	0	0	0	0	1	01
352	1	1	0	0	0	0	0	0	0	80
416	0	1	1	0	0	0	0	0	0	C0
480	0	0	1	1	0	0	0	0	0	60
33	1	0	0	1	1	0	0	0	0	30
97	1	1	0	0	1	1	0	0	0	98
161	0	1	1	0	0	1	1	0	0	CC
225	0	0	1	1	0	0	1	1	0	66
289	1	0	0	1	1	0	0	1	1	33
353	0	1	0	0	1	1	0	0	1	99
417	1	0	1	0	0	1	1	0	0	4C
481	0	1	0	1	0	0	1	1	0	A6
34	1	0	1	0	1	0	0	1	1	53
98	1	1	0	1	0	1	0	0	1	A9
162	0	1	1	0	1	0	1	0	0	D4
226	0	0	1	1	0	1	0	1	0	6A
290	1	0	0	1	1	0	1	0	1	35
354	0	1	0	0	1	1	0	1	0	9A
418	0	0	1	0	0	1	1	0	1	4D
482	1	0	0	1	0	0	1	1	0	26
35	1	1	0	0	1	0	0	1	1	93
99	1	1	1	0	0	1	0	0	1	C9
163	1	1	1	1	0	0	1	0	0	E4
227	1	1	1	1	1	0	0	1	0	F2
291	1	1	1	1	1	1	0	0	1	F9
355	0	1	1	1	1	1	1	0	0	FC
419	1	0	1	1	1	1	1	1	0	7E
483	1	1	0	1	1	1	1	1	1	BF
36	0	1	1	0	1	1	1	1	1	DF
100	1	0	1	1	0	1	1	1	1	6F
164	0	1	0	1	1	0	1	1	1	B7
228	0	0	1	0	1	1	0	1	1	5B
292	1	0	0	1	0	1	1	0	1	2D
356	0	1	0	0	1	0	1	1	0	96

420	0	0	1	0	0	1	0	1	1	4B
484	1	0	0	1	0	0	1	0	1	25
37	0	1	0	0	1	0	0	1	0	92
101	0	0	1	0	0	1	0	0	1	49
165	1	0	0	1	0	0	1	0	0	24
229	1	1	0	0	1	0	0	1	0	92
293	0	1	1	0	0	1	0	0	1	C9
357	1	0	1	1	0	0	1	0	0	64
421	1	1	0	1	1	0	0	1	0	B2
485	1	1	1	0	1	1	0	0	1	D9
38	1	1	1	1	0	1	1	0	0	EC
102	1	1	1	1	1	0	1	1	0	F6
166	1	1	1	1	1	1	0	1	1	FB
230	0	1	1	1	1	1	1	0	1	FD
294	0	0	1	1	1	1	1	1	0	7E
358	1	0	0	1	1	1	1	1	1	3F
422	0	1	0	0	1	1	1	1	1	9F
486	1	0	1	0	0	1	1	1	1	4F
39	1	1	0	1	0	0	1	1	1	A7
103	0	1	1	0	1	0	0	1	1	D3
167	1	0	1	1	0	1	0	0	1	69
231	0	1	0	1	1	0	1	0	0	B4
295	1	0	1	0	1	1	0	1	0	5A
359	0	1	0	1	0	1	1	0	1	AD
423	0	0	1	0	1	0	1	1	0	56
487	0	0	0	1	0	1	0	1	1	2B
40	0	0	0	0	1	0	1	0	1	15
104	1	0	0	0	0	1	0	1	0	0A
168	0	1	0	0	0	0	1	0	1	85
232	1	0	1	0	0	0	0	1	0	42
296	0	1	0	1	0	0	0	0	1	A1
360	0	0	1	0	1	0	0	0	0	50
424	0	0	0	1	0	1	0	0	0	28
488	1	0	0	0	1	0	1	0	0	14
41	0	1	0	0	0	1	0	1	0	8A
105	0	0	1	0	0	0	1	0	1	45
169	1	0	0	1	0	0	0	1	0	22
233	1	1	0	0	1	0	0	0	1	91
297	1	1	1	0	0	1	0	0	0	C8
361	0	1	1	1	0	0	1	0	0	E4
425	1	0	1	1	1	0	0	1	0	72
489	1	1	0	1	1	1	0	0	1	B9

42	0	1	1	0	1	1	1	0	0	DC
106	0	0	1	1	0	1	1	1	0	6E
170	1	0	0	1	1	0	1	1	1	37
234	0	1	0	0	1	1	0	1	1	9B
298	1	0	1	0	0	1	1	0	1	4D
362	1	1	0	1	0	0	1	1	0	A6
426	1	1	1	0	1	0	0	1	1	D3
490	1	1	1	1	0	1	0	0	1	E9
43	0	1	1	1	1	0	1	0	0	F4
107	1	0	1	1	1	1	0	1	0	7A
171	1	1	0	1	1	1	1	0	1	BD
235	0	1	1	0	1	1	1	1	0	DE
299	0	0	1	1	0	1	1	1	1	6F
363	0	0	0	1	1	0	1	1	1	37
427	0	0	0	0	1	1	0	1	1	1B
491	1	0	0	0	0	1	1	0	1	0D
44	1	1	0	0	0	0	1	1	0	86
108	0	1	1	0	0	0	0	1	1	C3
172	1	0	1	1	0	0	0	0	1	61
236	0	1	0	1	1	0	0	0	0	B0
300	1	0	1	0	1	1	0	0	0	58
364	0	1	0	1	0	1	1	0	0	AC
428	1	0	1	0	1	0	1	1	0	56
492	0	1	0	1	0	1	0	1	1	AB
45	0	0	1	0	1	0	1	0	1	55
109	1	0	0	1	0	1	0	1	0	2A
173	1	1	0	0	1	0	1	0	1	95
237	1	1	1	0	0	1	0	1	0	CA
301	0	1	1	1	0	0	1	0	1	E5
365	0	0	1	1	1	0	0	1	0	72
429	1	0	0	1	1	1	0	0	1	39
493	0	1	0	0	1	1	1	0	0	9C
46	0	0	1	0	0	1	1	1	0	4E
110	0	0	0	1	0	0	1	1	1	27
174	0	0	0	0	1	0	0	1	1	13
238	1	0	0	0	0	1	0	0	1	09
302	1	1	0	0	0	0	1	0	0	84
366	0	1	1	0	0	0	0	1	0	C2
430	0	0	1	1	0	0	0	0	1	61
494	0	0	0	1	1	0	0	0	0	30
47	1	0	0	0	1	1	0	0	0	18
111	0	1	0	0	0	1	1	0	0	8C

175	0	0	1	0	0	0	1	1	0	46
239	0	0	0	1	0	0	0	1	1	23
303	0	0	0	0	1	0	0	0	1	11
367	1	0	0	0	0	1	0	0	0	08
431	0	1	0	0	0	0	1	0	0	84
495	0	0	1	0	0	0	0	1	0	42
48	0	0	0	1	0	0	0	0	1	21
112	0	0	0	0	1	0	0	0	0	10
176	0	0	0	0	0	1	0	0	0	08
240	0	0	0	0	0	0	1	0	0	04
304	0	0	0	0	0	0	0	1	0	02
368	0	0	0	0	0	0	0	0	1	01
432	1	0	0	0	0	0	0	0	0	00
496	0	1	0	0	0	0	0	0	0	80
49	0	0	1	0	0	0	0	0	0	40
113	0	0	0	1	0	0	0	0	0	20
177	1	0	0	0	1	0	0	0	0	10
241	0	1	0	0	0	1	0	0	0	88
305	0	0	1	0	0	0	1	0	0	44
369	0	0	0	1	0	0	0	1	0	22
433	1	0	0	0	1	0	0	0	1	11
497	1	1	0	0	0	1	0	0	0	88
50	0	1	1	0	0	0	1	0	0	C4
114	0	0	1	1	0	0	0	1	0	62
178	1	0	0	1	1	0	0	0	1	31
242	0	1	0	0	1	1	0	0	0	98
306	0	0	1	0	0	1	1	0	0	4C
370	0	0	0	1	0	0	1	1	0	26
434	1	0	0	0	1	0	0	1	1	13
498	1	1	0	0	0	1	0	0	1	89
51	1	1	1	0	0	0	1	0	0	C4
115	0	1	1	1	0	0	0	1	0	E2
179	1	0	1	1	1	0	0	0	1	71
243	0	1	0	1	1	1	0	0	0	B8
307	1	0	1	0	1	1	1	0	0	5C
371	0	1	0	1	0	1	1	1	0	AE
435	1	0	1	0	1	0	1	1	1	57
499	1	1	0	1	0	1	0	1	1	AB
52	0	1	1	0	1	0	1	0	1	D5
116	1	0	1	1	0	1	0	1	0	6A
180	1	1	0	1	1	0	1	0	1	B5
244	0	1	1	0	1	1	0	1	0	DA

308	0	0	1	1	0	1	1	0	1	6D
372	0	0	0	1	1	0	1	1	0	36
436	1	0	0	0	1	1	0	1	1	1B
500	1	1	0	0	0	1	1	0	1	8D
53	1	1	1	0	0	0	1	1	0	C6
117	0	1	1	1	0	0	0	1	1	E3
181	0	0	1	1	1	0	0	0	1	71
245	0	0	0	1	1	1	0	0	0	38
309	1	0	0	0	1	1	1	0	0	1C
373	0	1	0	0	0	1	1	1	0	8E
437	0	0	1	0	0	0	1	1	1	47
501	1	0	0	1	0	0	0	1	1	23
54	0	1	0	0	1	0	0	0	1	91
118	1	0	1	0	0	1	0	0	0	48
182	0	1	0	1	0	0	1	0	0	A4
246	1	0	1	0	1	0	0	1	0	52
310	0	1	0	1	0	1	0	0	1	A9
374	0	0	1	0	1	0	1	0	0	54
438	0	0	0	1	0	1	0	1	0	2A
502	1	0	0	0	1	0	1	0	1	15
55	1	1	0	0	0	1	0	1	0	8A
119	0	1	1	0	0	0	1	0	1	C5
183	1	0	1	1	0	0	0	1	0	62
247	1	1	0	1	1	0	0	0	1	B1
311	0	1	1	0	1	1	0	0	0	D8
375	0	0	1	1	0	1	1	0	0	6C
439	1	0	0	1	1	0	1	1	0	36
503	1	1	0	0	1	1	0	1	1	9B
56	1	1	1	0	0	1	1	0	1	CD
120	1	1	1	1	0	0	1	1	0	E6
184	1	1	1	1	1	0	0	1	1	F3
248	0	1	1	1	1	1	0	0	1	F9
312	0	0	1	1	1	1	1	0	0	7C
376	1	0	0	1	1	1	1	1	0	3E
440	1	1	0	0	1	1	1	1	1	9F
504	1	1	1	0	0	1	1	1	1	CF
57	1	1	1	1	0	0	1	1	1	E7
121	0	1	1	1	1	0	0	1	1	F3
185	0	0	1	1	1	1	0	0	1	79
249	0	0	0	1	1	1	1	0	0	3C
313	1	0	0	0	1	1	1	1	0	1E
377	0	1	0	0	0	1	1	1	1	8F

441	1	0	1	0	0	0	1	1	1	47
505	1	1	0	1	0	0	0	1	1	A3
58	0	1	1	0	1	0	0	0	1	D1
122	1	0	1	1	0	1	0	0	0	68
186	1	1	0	1	1	0	1	0	0	B4
250	1	1	1	0	1	1	0	1	0	DA
314	0	1	1	1	0	1	1	0	1	ED
378	0	0	1	1	1	0	1	1	0	76
442	1	0	0	1	1	1	0	1	1	3B
506	0	1	0	0	1	1	1	0	1	9D
59	1	0	1	0	0	1	1	1	0	4E
123	0	1	0	1	0	0	1	1	1	A7
187	0	0	1	0	1	0	0	1	1	53
251	1	0	0	1	0	1	0	0	1	29
315	0	1	0	0	1	0	1	0	0	94
379	0	0	1	0	0	1	0	1	0	4A
443	0	0	0	1	0	0	1	0	1	25
507	0	0	0	0	1	0	0	1	0	12
60	0	0	0	0	0	1	0	0	1	09
124	1	0	0	0	0	0	1	0	0	04
188	0	1	0	0	0	0	0	1	0	82
252	0	0	1	0	0	0	0	0	1	41
316	1	0	0	1	0	0	0	0	0	20
380	1	1	0	0	1	0	0	0	0	90
444	0	1	1	0	0	1	0	0	0	C8
508	0	0	1	1	0	0	1	0	0	64
61	1	0	0	1	1	0	0	1	0	32
125	1	1	0	0	1	1	0	0	1	99
189	1	1	1	0	0	1	1	0	0	CC
253	0	1	1	1	0	0	1	1	0	E6
317	1	0	1	1	1	0	0	1	1	73
381	0	1	0	1	1	1	0	0	1	B9
445	0	0	1	0	1	1	1	0	0	5C
509	0	0	0	1	0	1	1	1	0	2E
62	1	0	0	0	1	0	1	1	1	17
126	1	1	0	0	0	1	0	1	1	8B
190	1	1	1	0	0	0	1	0	1	C5
254	1	1	1	1	0	0	0	1	0	E2
318	1	1	1	1	1	0	0	0	1	F1
382	0	1	1	1	1	1	0	0	0	F8
446	1	0	1	1	1	1	1	0	0	7C
510	1	1	0	1	1	1	1	1	0	BE

63	1	1	1	0	1	1	1	1	1	DF
127	1	1	1	1	0	1	1	1	1	EF
191	0	1	1	1	1	0	1	1	1	F7
255	0	0	1	1	1	1	0	1	1	7B
319	0	0	0	1	1	1	1	0	1	3D
383	0	0	0	0	1	1	1	1	0	1E
447	0	0	0	0	0	1	1	1	1	0F
511	1	0	0	0	0	0	1	1	1	07
64	1	1	0	0	0	0	0	1	1	83
128	1	1	1	0	0	0	0	0	1	C1
192	1	1	1	1	0	0	0	0	0	E0
256	1	1	1	1	1	0	0	0	0	F0
320	1	1	1	1	1	1	0	0	0	F8
384	1	1	1	1	1	1	1	0	0	FC
448	1	1	1	1	1	1	1	1	0	FE

Table 2. Sequential States of the Pseudorandom Generator

7 References

[1] CC430 User's Guide (SLAU259.pdf)
[2] CC1100 Single-Chip Low-Cost Power RF-Transceiver Data Sheet (SWRS038.pdf)
[3] CC1100E Low-Power Sub-GHz RF Transceiver (470-510 MHz & 950-960 MHz) (SWRS082.pdf)
[4] CC1101 Single-Chip Low Cost Low Power RF-Transceiver Data Sheet (SWRS061.pdf)
[5] CC1110Fx/CC1111Fx Low-Power Sub-1 GHz RF System-on-Chip (SoC) with MCU, Memory, Transciver, and USB Controller (SWRS033.pdf)
[6] CC1150 Single Chip Low Cost Low Power RF-Transmitter (SWRS037.pdf)
[7] CC2500 Single-Chip Low Cost Low Power RF-Transceiver Data Sheet (SWRS040.pdf)
[8] CC2510Fx/CC2511Fx Low-Power SoC (System-on Chip) with MCU, Memory, 2.4 GHz 2.4 GHz RF Transceiver and USB Controller (SWRS055.pdf)
[9] CC2550 Low-Cost Low-Power 2.4 GHz RF Transmitter (SWRS039.pdf)

Document History

Revision	Date	Description/Changes
SWRAxxx	yyyy.mm.dd	Initial release.

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