G.3.2 Generation of the long sequences

The frequency domain representation of the long training sequence part of the preamble is given in Table G.5.

Table G.5—Frequency domain representation of the long sequences

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
–32	0.000	0.000	-16	1.000	0.000	0	0.000	0.000	16	1.000	0.000
–31	0.000	0.000	-15	1.000	0.000	1	1.000	0.000	17	–1.000	0.000
–30	0.000	0.000	-14	1.000	0.000	2	–1.000	0.000	18	–1.000	0.000
–29	0.000	0.000	-13	1.000	0.000	3	–1.000	0.000	19	1.000	0.000
–28	0.000	0.000	-12	1.000	0.000	4	1.000	0.000	20	–1.000	0.000
–27	0.000	0.000	-11	–1.000	0.000	5	1.000	0.000	21	1.000	0.000
–26	1.000	0.000	-10	–1.000	0.000	6	–1.000	0.000	22	–1.000	0.000
–25	1.000	0.000	-9	1.000	0.000	7	1.000	0.000	23	1.000	0.000
–24	–1.000	0.000	-8	1.000	0.000	8	–1.000	0.000	24	1.000	0.000
–23	–1.000	0.000	-7	–1.000	0.000	9	1.000	0.000	25	1.000	0.000
–22	1.000	0.000	-6	1.000	0.000	10	–1.000	0.000	26	1.000	0.000
–21	1.000	0.000	-5	–1.000	0.000	11	–1.000	0.000	27	0.000	0.000
–20	–1.000	0.000	-4	1.000	0.000	12	–1.000	0.000	28	0.000	0.000
–19	1.000	0.000	-3	1.000	0.000	13	–1.000	0.000	29	0.000	0.000
–18	–1.000	0.000	-2	1.000	0.000	14	–1.000	0.000	30	0.000	0.000
–17	1.000	0.000	-1	1.000	0.000	15	1.000	0.000	31	0.000	0.000

The time domain representation is derived by performing IFFT on the contents of Table G.5, cyclically extending the result to get the cyclic prefix, and then multiplying with the window function given in G.3.1. The resulting 161 points vector is shown in Table G.6. The samples are appended to the short sequence section by overlapping and adding element 160 of Table G.4 to element 0 of Table G.6.

G.4 Generation of the SIGNAL field

G.4.1 SIGNAL field bit assignment

The SIGNAL field bit assignment follows 17.3.4 and Figure 111. The transmitted bits are shown in Table G.7, where bit 0 is transmitted first.

G.4.2 Coding the SIGNAL field bits.

The bits are encoded by the rate 1/2 convolutional encoder to yield the 48 bits given in Table G.8.

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Table G.6—Time domain representation of the long sequences

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
0	–0.078	0.000	40	0.098	–0.026	80	0.062	0.062	120	–0.035	–0.151
1	0.012	–0.098	41	0.053	0.004	81	0.119	0.004	121	–0.122	–0.017
2	0.092	–0.106	42	0.001	–0.115	82	–0.022	–0.161	122	–0.127	–0.021
3	–0.092	–0.115	43	–0.137	–0.047	83	0.059	0.015	123	0.075	–0.074
4	–0.003	–0.054	44	0.024	–0.059	84	0.024	0.059	124	–0.003	0.054
5	0.075	0.074	45	0.059	–0.015	85	–0.137	0.047	125	–0.092	0.115
6	–0.127	0.021	46	–0.022	0.161	86	0.001	0.115	126	0.092	0.106
7	–0.122	0.017	47	0.119	–0.004	87	0.053	–0.004	127	0.012	0.098
8	–0.035	0.151	48	0.062	–0.062	88	0.098	0.026	128	–0.156	0.000
9	–0.056	0.022	49	0.037	0.098	89	–0.038	0.106	129	0.012	–0.098
10	–0.060	–0.081	50	–0.057	0.039	90	–0.115	0.055	130	0.092	–0.106
11	0.070	–0.014	51	–0.131	0.065	91	0.060	0.088	131	–0.092	–0.115
12	0.082	–0.092	52	0.082	0.092	92	0.021	–0.028	132	–0.003	–0.054
13	–0.131	–0.065	53	0.070	0.014	93	0.097	–0.083	133	0.075	0.074
14	–0.057	–0.039	54	–0.060	0.081	94	0.040	0.111	134	–0.127	0.021
15	0.037	–0.098	55	–0.056	–0.022	95	–0.005	0.120	135	–0.122	0.017
16	0.062	0.062	56	–0.035	–0.151	96	0.156	0.000	136	–0.035	0.151
17	0.119	0.004	57	–0.122	–0.017	97	–0.005	–0.120	137	–0.056	0.022
18	–0.022	–0.161	58	–0.127	–0.021	98	0.040	–0.111	138	–0.060	–0.081
19	0.059	0.015	59	0.075	–0.074	99	0.097	0.083	139	0.070	–0.014
20	0.024	0.059	60	–0.003	0.054	100	0.021	0.028	140	0.082	–0.092
21	–0.137	0.047	61	–0.092	0.115	101	0.060	–0.088	141	–0.131	–0.065
22	0.001	0.115	62	0.092	0.106	102	–0.115	–0.055	142	–0.057	–0.039
23	0.053	–0.004	63	0.012	0.098	103	–0.038	–0.106	143	0.037	–0.098
24	0.098	0.026	64	–0.156	0.000	104	0.098	–0.026	144	0.062	0.062
25	–0.038	0.106	65	0.012	–0.098	105	0.053	0.004	145	0.119	0.004
26	–0.115	0.055	66	0.092	–0.106	106	0.001	–0.115	146	–0.022	–0.161
27	0.060	0.088	67	–0.092	–0.115	107	–0.137	–0.047	147	0.059	0.015
28	0.021	–0.028	68	–0.003	–0.054	108	0.024	–0.059	148	0.024	0.059
29	0.097	–0.083	69	0.075	0.074	109	0.059	–0.015	149	–0.137	0.047
30	0.040	0.111	70	–0.127	0.021	110	–0.022	0.161	150	0.001	0.115
31	–0.005	0.120	71	–0.122	0.017	111	0.119	–0.004	151	0.053	–0.004
32	0.156	0.000	72	–0.035	0.151	112	0.062	–0.062	152	0.098	0.026
33	–0.005	–0.120	73	–0.056	0.022	113	0.037	0.098	153	–0.038	0.106
34	0.040	–0.111	74	–0.060	–0.081	114	–0.057	0.039	154	–0.115	0.055
35	0.097	0.083	75	0.070	–0.014	115	–0.131	0.065	155	0.060	0.088
36	0.021	0.028	76	0.082	–0.092	116	0.082	0.092	156	0.021	–0.028
37	0.060	–0.088	77	–0.131	–0.065	117	0.070	0.014	157	0.097	–0.083
38	–0.115	–0.055	78	–0.057	–0.039	118	–0.060	0.081	158	0.040	0.111
39	–0.038	–0.106	79	0.037	–0.098	119	–0.056	–0.022	159	–0.005	0.120
									160	0.078	0

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Table G.7—Bit assignment for SIGNAL field

##	Bit	Meaning		##	Bit	Meaning
0	1	RATE: R1		12	0	—
1	0	RATE: R2		13	0	—
2	1	RATE: R3		14	0	—
3	1	RATE: R4		15	0	—
4	0	Reserved		16	0	LENGTH (MSB)
5	0	LENGTH (LSB)		17	0	Parity
6	0	—		18	0	SIGNAL TAIL
7	1	—		19	0	SIGNAL TAIL
8	0	—		20	0	SIGNAL TAIL
9	0	—		21	0	SIGNAL TAIL
10	1	—		22	0	SIGNAL TAIL
11	1	—		23	0	SIGNAL TAIL

Table G.8—SIGNAL field bits after encoding

##	Bit		##	Bit		##	Bit		##	Bit		##	Bit		##	Bit
0	1		8	1		16	0		24	0		32	0		40	0
1	1		9	0		17	0		25	0		33	1		41	0
2	0		10	1		18	0		26	1		34	1		42	0
3	1		11	0		19	0		27	1		35	1		43	0
4	0		12	0		20	0		28	1		36	0		44	0
5	0		13	0		21	0		29	1		37	0		45	0
6	0		14	0		22	1		30	1		38	0		46	0
7	1		15	1		23	0		31	0		39	0		47	0

G.4.3 Interleaving the SIGNAL field bits.

The encoded bits are interleaved according to the interleaver of 17.3.5.6. A detailed breakdown of the interleaving operation is described in G.7. The interleaved SIGNAL field bits are shown in Table G.9.

G.4.4 SIGNAL field frequency domain

The encoded and interleaved bits are BPSK modulated to yield the frequency domain representation given in Table G.10. Locations –21, –7, 7, and 21 are skipped and will be used for pilot insertion.

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Table G.9—SIGNAL field bits after interleaving

##	Bit	##	Bit	##	Bit	##	Bit	##	Bit	##	Bit
0	1	8	1	16	0	24	1	32	0	40	1
1	0	9	1	17	0	25	0	33	0	41	0
2	0	10	0	18	0	26	0	34	1	42	0
3	1	11	1	19	1	27	0	35	0	43	1
4	0	12	0	20	0	28	0	36	0	44	0
5	1	13	0	21	1	29	0	37	1	45	1
6	0	14	0	22	0	30	1	38	0	46	0
7	0	15	0	23	0	31	1	39	0	47	0

Table G.10—Frequency domain representation of SIGNAL field

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
–32	0.000	0.000	–16	1.000	0.000	0	0.000	0.000	16	–1.000	0.000
–31	0.000	0.000	–15	–1.000	0.000	1	1.000	0.000	17	–1.000	0.000
–30	0.000	0.000	–14	1.000	0.000	2	–1.000	0.000	18	1.000	0.000
–29	0.000	0.000	–13	–1.000	0.000	3	–1.000	0.000	19	–1.000	0.000
–28	0.000	0.000	–12	–1.000	0.000	4	–1.000	0.000	20	–1.000	0.000
–27	0.000	0.000	–11	–1.000	0.000	5	–1.000	0.000	21	X	X
–26	1.000	0.000	–10	–1.000	0.000	6	–1.000	0.000	22	1.000	0.000
–25	–1.000	0.000	–9	–1.000	0.000	7	X	X	23	–1.000	0.000
–24	–1.000	0.000	–8	–1.000	0.000	8	1.000	0.000	24	1.000	0.000
–23	1.000	0.000	–7	X	X	9	1.000	0.000	25	–1.000	0.000
–22	–1.000	0.000	–6	–1.000	0.000	10	–1.000	0.000	26	–1.000	0.000
–21	X	X	–5	1.000	0.000	11	–1.000	0.000	27	0.000	0.000
–20	1.000	0.000	–4	–1.000	0.000	12	1.000	0.000	28	0.000	0.000
–19	–1.000	0.000	–3	1.000	0.000	13	–1.000	0.000	29	0.000	0.000
–18	–1.000	0.000	–2	–1.000	0.000	14	–1.000	0.000	30	0.000	0.000
–17	1.000	0.000	–1	–1.000	0.000	15	1.000	0.000	31	0.000	0.000

Four pilot subcarriers are added by taking the values {1.0,1.0,1.0,-1.0}, multiplying them by the first element of sequence $p_{0...126}$, given in Equation (22), and inserting them into location {–21,–7,7,21}, respectively. The resulting frequency domain values are given in Table G.11.

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Table G.11—Frequency domain representation of SIGNAL field with pilots inserted

##	Re	Im		##	Re	Im		##	Re	Im		##	Re	Im
–32	0.000	0.000		–16	1.000	0.000		0	0.000	0.000		16	–1.000	0.000
–31	0.000	0.000		–15	–1.000	0.000		1	1.000	0.000		17	–1.000	0.000
–30	0.000	0.000		–14	1.000	0.000		2	–1.000	0.000		18	1.000	0.000
–29	0.000	0.000		–13	–1.000	0.000		3	–1.000	0.000		19	–1.000	0.000
–28	0.000	0.000		–12	–1.000	0.000		4	–1.000	0.000		20	–1.000	0.000
–27	0.000	0.000		–11	–1.000	0.000		5	–1.000	0.000		21	–1.000	0.000
–26	1.000	0.000		–10	–1.000	0.000		6	–1.000	0.000		22	1.000	0.000
–25	–1.000	0.000		–9	–1.000	0.000		7	1.000	0.000		23	–1.000	0.000
–24	–1.000	0.000		–8	–1.000	0.000		8	1.000	0.000		24	1.000	0.000
–23	1.000	0.000		–7	1.000	0.000		9	1.000	0.000		25	–1.000	0.000
–22	–1.000	0.000		–6	–1.000	0.000		10	–1.000	0.000		26	–1.000	0.000
–21	1.000	0.000		–5	1.000	0.000		11	–1.000	0.000		27	0.000	0.000
–20	1.000	0.000		–4	–1.000	0.000		12	1.000	0.000		28	0.000	0.000
–19	–1.000	0.000		–3	1.000	0.000		13	–1.000	0.000		29	0.000	0.000
–18	–1.000	0.000		–2	–1.000	0.000		14	–1.000	0.000		30	0.000	0.000
–17	1.000	0.000		–1	–1.000	0.000		15	1.000	0.000		31	0.000	0.000

G.4.5 SIGNAL field time domain

The time domain representation is derived by performing IFFT on the contents of Table G.11, extending cyclically, and multiplying by the window function

$$W(k) = \begin{bmatrix} 0.5 & k = 0 \\ 1 & 1 \le k \le 8 \\ 0.5 & k = 80 \end{bmatrix}$$

The resulting 81 samples vector is shown in Table G.12. Note that the time-windowing feature illustrated here is not a part of the normative specifications.

The SIGNAL field samples are appended with one sample overlap to the preamble, given in Table G.6.

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Table G.12—Time domain representation of SIGNAL field

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
0	0.031	0.000	20	0.010	–0.097	40	–0.035	0.044	60	–0.051	0.202
1	0.033	–0.044	21	–0.060	–0.124	41	0.017	–0.059	61	0.035	–0.116
2	–0.002	–0.038	22	–0.033	–0.044	42	0.053	–0.017	62	0.016	–0.174
3	–0.081	0.084	23	0.011	0.002	43	0.099	0.100	63	0.057	–0.052
4	0.007	–0.100	24	0.098	0.044	44	0.034	–0.148	64	0.062	0.000
5	–0.001	–0.113	25	0.136	0.105	45	–0.003	–0.094	65	0.033	–0.044
6	–0.021	–0.005	26	–0.021	0.005	46	–0.120	0.042	66	–0.002	–0.038
7	0.136	–0.105	27	–0.001	0.113	47	–0.136	–0.070	67	–0.081	0.084
8	0.098	–0.044	28	0.007	0.100	48	–0.031	0.000	68	0.007	–0.100
9	0.011	–0.002	29	–0.081	–0.084	49	–0.136	0.070	69	–0.001	–0.113
10	–0.033	0.044	30	–0.002	0.038	50	–0.120	–0.042	70	–0.021	–0.005
11	–0.060	0.124	31	0.033	0.044	51	–0.003	0.094	71	0.136	–0.105
12	0.010	0.097	32	0.062	0.000	52	0.034	0.148	72	0.098	–0.044
13	0.000	–0.008	33	0.057	0.052	53	0.099	–0.100	73	0.011	–0.002
14	0.018	–0.083	34	0.016	0.174	54	0.053	0.017	74	–0.033	0.044
15	–0.069	0.027	35	0.035	0.116	55	0.017	0.059	75	–0.060	0.124
16	–0.219	0.000	36	–0.051	–0.202	56	–0.035	–0.044	76	0.010	0.097
17	–0.069	–0.027	37	0.011	0.036	57	–0.049	0.008	77	0.000	–0.008
18	0.018	0.083	38	0.089	0.209	58	0.089	–0.209	78	0.018	–0.083
19	0.000	0.008	39	–0.049	–0.008	59	0.011	–0.036	79	–0.069	0.027
									80	–0.109	0.000

G.5 Generating the DATA bits

G.5.1 Delineating, SERVICE field prepending, and zero padding

The transmitted message shown in Table G.1 contains 100 octets or, equivalently, 800 bits. The bits are prepended by the 16 SERVICE field bits and are appended by 6 tail bits. The resulting 822 bits are appended by zero bits to yield an integer number of OFDM symbols. For the 36 Mbit/s mode, there are 144 data bits per OFDM symbol; the overall number of bits is ceil (822/6) × 144 = 864. Hence, 864 – 822 = 42 zero bits are appended.

The data bits are shown in Table G.13 and Table G.14. For clarity, only the first and last 144 bits are shown.

G.5.2 Scrambling

The 864 bits are scrambled by the scrambler of Figure 113. The initial state of the scrambler is the state 1011101. The generated scrambling sequence is given in Table G.15.

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Table G.13—First 144 DATA bits

##	Bit	##	Bit	##	Bit	##	Bit	##	Bit	##	Bit
0	0	24	0	48	0	72	1	96	0	120	1
1	0	25	1	49	0	73	0	97	0	121	0
2	0	26	0	50	0	74	1	98	0	122	0
3	0	27	0	51	0	75	1	99	0	123	0
4	0	28	0	52	0	76	0	100	0	124	0
5	0	29	0	53	0	77	0	101	0	125	0
6	0	30	0	54	0	78	1	102	0	126	0
7	0	31	0	55	0	79	1	103	0	127	0
8	0	32	0	56	0	80	1	104	0	128	0
9	0	33	0	57	0	81	1	105	0	129	0
10	0	34	0	58	0	82	1	106	0	130	1
11	0	35	0	59	0	83	0	107	0	131	1
12	0	36	0	60	0	84	1	108	0	132	1
13	0	37	0	61	1	85	1	109	1	133	1
14	0	38	0	62	1	86	0	110	0	134	0
15	0	39	0	63	0	87	0	111	0	135	0
16	0	40	0	64	0	88	0	112	0	136	1
17	0	41	1	65	0	89	1	113	1	137	0
18	1	42	1	66	0	90	1	114	1	138	0
19	0	43	1	67	1	91	0	115	0	139	0
20	0	44	0	68	0	92	0	116	1	140	1
21	0	45	1	69	0	93	1	117	0	141	1
22	0	46	0	70	0	94	0	118	1	142	1
23	0	47	0	71	0	95	1	119	1	143	1

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Table G.14—Last 144 DATA bits

##	Bit	##	Bit	##	Bit	##	Bit	##	Bit	##	Bit
720	0	744	0	768	1	792	1	816	0	840	0
721	0	745	0	769	0	793	1	817	0	841	0
722	0	746	0	770	1	794	1	818	0	842	0
723	0	747	0	771	0	795	0	819	0	843	0
724	0	748	0	772	0	796	1	820	0	844	0
725	1	749	1	773	1	797	0	821	0	845	0
726	0	750	0	774	1	798	1	822	0	846	0
727	0	751	0	775	0	799	0	823	0	847	0
728	1	752	0	776	1	800	1	824	0	848	0
729	1	753	0	777	0	801	0	825	0	849	0
730	1	754	1	778	0	802	0	826	0	850	0
731	0	755	0	779	0	803	1	827	0	851	0
732	1	756	1	780	0	804	1	828	0	852	0
733	1	757	1	781	1	805	0	829	0	853	0
734	1	758	1	782	1	806	0	830	0	854	0
735	0	759	0	783	0	807	1	831	0	855	0
736	1	760	0	784	0	808	1	832	0	856	0
737	0	761	1	785	1	809	0	833	0	857	0
738	1	762	0	786	0	810	1	834	0	858	0
739	0	763	0	787	1	811	1	835	0	859	0
740	0	764	1	788	1	812	0	836	0	860	0
741	1	765	1	789	0	813	1	837	0	861	0
742	1	766	1	790	1	814	1	838	0	862	0
743	0	767	0	791	1	815	1	839	0	863	0

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Table G.15—Scrambling sequence for seed 1011101

0	0	16	1	32	0	48	1	64	0	80	0	96	0	112	1
1	1	17	0	33	1	49	1	65	1	81	0	97	0	113	0
2	1	18	1	34	1	50	1	66	1	82	1	98	1	114	0
3	0	19	0	35	0	51	1	67	1	83	1	99	0	115	1
4	1	20	1	36	1	52	0	68	0	84	1	100	0	116	1
5	1	21	0	37	0	53	1	69	0	85	0	101	1	117	0
6	0	22	0	38	0	54	0	70	0	86	1	102	0	118	0
7	0	23	1	39	0	55	0	71	1	87	1	103	0	119	0
8	0	24	1	40	0	56	1	72	1	88	1	104	0	120	1
9	0	25	1	41	1	57	0	73	1	89	1	105	0	121	0
10	0	26	0	42	0	58	1	74	1	90	0	106	0	122	1
11	1	27	0	43	1	59	0	75	1	91	0	107	0	123	1
12	1	28	1	44	0	60	0	76	1	92	1	108	1	124	1
13	0	29	1	45	1	61	0	77	1	93	0	109	0	125	0
14	0	30	1	46	0	62	1	78	0	94	1	110	0	126	1
15	1	31	1	47	1	63	1	79	0	95	1	111	0		

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After scrambling, the 6 bits in location 816 (i.e., the 817th bit) to 821 (the 822nd bit) are zeroed. The first and last 144 scrambled bits are shown in Table G.16 and Table G.17, respectively.

Table G.16—First 144 bits after scrambling

##	Bit	##	Bit	##	Bit	##	Bit	##	Bit	##	Bit
0	0	24	1	48	1	72	0	96	0	120	0
1	1	25	0	49	1	73	1	97	0	121	0
2	1	26	0	50	1	74	0	98	1	122	1
3	0	27	0	51	1	75	0	99	0	123	1
4	1	28	1	52	0	76	1	100	0	124	1
5	1	29	1	53	1	77	1	101	1	125	0
6	0	30	1	54	0	78	1	102	0	126	1
7	0	31	1	55	0	79	1	103	0	127	0
8	0	32	0	56	1	80	1	104	0	128	1
9	0	33	1	57	0	81	1	105	0	129	1
10	0	34	1	58	1	82	0	106	0	130	1
11	1	35	0	59	0	83	1	107	0	131	0
12	1	36	1	60	0	84	0	108	1	132	0
13	0	37	0	61	1	85	1	109	1	133	1
14	0	38	0	62	0	86	1	110	0	134	0
15	1	39	0	63	1	87	1	111	0	135	0
16	1	40	0	64	0	88	1	112	1	136	1
17	0	41	0	65	1	89	0	113	1	137	0
18	0	42	1	66	1	90	1	114	1	138	1
19	0	43	0	67	0	91	0	115	1	139	1
20	1	44	0	68	0	92	1	116	0	140	1
21	0	45	0	69	0	93	1	117	0	141	1
22	0	46	0	70	0	94	1	118	1	142	0
23	1	47	1	71	1	95	0	119	1	143	0

G.6.1 Coding the DATA bits

The scrambled bits are coded with a rate Ω convolutional code. The first 144 scrambled bits of Table G.16 are mapped into the 192 bits of Table G.18.

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Table G.17—Last 144 bits after scrambling

##	Bit	##	Bit	##	Bit	##	Bit	##	Bit	##	Bit
720	0	744	0	768	1	792	0	816	0	840	0
721	1	745	0	769	0	793	0	817	0	841	0
722	1	746	0	770	1	794	1	818	0	842	0
723	1	747	1	771	0	795	1	819	0	843	0
724	1	748	0	772	0	796	0	820	0	844	1
725	1	749	1	773	0	797	0	821	0	845	1
726	0	750	1	774	0	798	0	822	0	846	1
727	1	751	1	775	0	799	0	823	0	847	0
728	1	752	0	776	1	800	1	824	1	848	1
729	0	753	0	777	1	801	0	825	1	849	1
730	0	754	1	778	1	802	0	826	0	850	1
731	0	755	1	779	0	803	0	827	1	851	1
732	1	756	1	780	1	804	1	828	1	852	0
733	0	757	0	781	1	805	1	829	1	853	0
734	1	758	0	782	0	806	0	830	0	854	1
735	0	759	1	783	0	807	0	831	0	855	0
736	0	760	0	784	0	808	1	832	0	856	1
737	0	761	0	785	0	809	1	833	1	857	1
738	1	762	0	786	1	810	0	834	1	858	0
739	0	763	1	787	0	811	0	835	1	859	0
740	0	764	0	788	1	812	1	836	1	860	1
741	1	765	1	789	0	813	0	837	1	861	0
742	1	766	0	790	0	814	1	838	1	862	0
743	1	767	1	791	0	815	0	839	1	863	1

G.6.2 Interleaving the DATA bits

The interleaver is defined as a two-permutation process. We shall denote by k the index of the coded bit before the first permutation; i shall be the index after the first and before the second permutation; and j shall be the index after the second permutation, just prior to modulation mapping. The mapping from k to i is shown in Table G.19, and the mapping from i to j is shown in Table G.20.

As a specific example, consider the case of $k = 17$ (the 18^{th} bit after encoding and puncturing). It is mapped by the first permutation to $i = 13$ and by the second permutation to $j = 12$ (the 13^{th} bit before mapping).

The interleaved bits are shown in Table G.21.

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Table G.18—Coded bits of first DATA symbol

##	Bit	##	Bit	##	Bit	##	Bit	##	Bit	##	Bit
0	0	32	1	64	0	96	1	128	1	160	1
1	0	33	0	65	1	97	0	129	1	161	1
2	1	34	0	66	0	98	0	130	0	162	1
3	0	35	1	67	0	99	0	131	0	163	0
4	1	36	1	68	1	100	1	132	0	164	0
5	0	37	1	69	0	101	1	133	0	165	0
6	1	38	0	70	1	102	1	134	0	166	0
7	1	39	1	71	0	103	1	135	0	167	0
8	0	40	1	72	1	104	1	136	0	168	1
9	0	41	0	73	1	105	1	137	1	169	1
10	0	42	1	74	1	106	0	138	0	170	0
11	0	43	1	75	1	107	0	139	0	171	1
12	1	44	0	76	1	108	0	140	0	172	0
13	0	45	1	77	0	109	0	141	0	173	0
14	0	46	0	78	1	110	0	142	1	174	1
15	0	47	1	79	1	111	0	143	1	175	1
16	1	48	1	80	1	112	1	144	1	176	1
17	0	49	0	81	1	113	1	145	1	177	1
18	1	50	0	82	1	114	0	146	1	178	1
19	0	51	1	83	0	115	0	147	0	179	0
20	0	52	1	84	1	116	1	148	0	180	1
21	0	53	0	85	0	117	0	149	0	181	0
22	0	54	1	86	0	118	0	150	0	182	1
23	1	55	0	87	0	119	0	151	0	183	1
24	1	56	0	88	1	120	0	152	0	184	1
25	1	57	0	89	1	121	1	153	0	185	0
26	1	58	0	90	0	122	1	154	0	186	1
27	1	59	1	91	0	123	1	155	1	187	1
28	0	60	1	92	0	124	0	156	1	188	0
29	0	61	1	93	0	125	0	157	0	189	0
30	0	62	0	94	1	126	1	158	0	190	1
31	0	63	1	95	0	127	1	159	1	191	0

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Table G.19—First permutation

k	*i*	*k*	*i*	*k*	*i*	*k*	*i*	*k*	*i*	*k*	*i*	*k*	*i*	*k*	*i*
0	0	24	97	48	3	72	100	96	6	120	103	144	9	168	106
1	12	25	109	49	15	73	112	97	18	121	115	145	21	169	118
2	24	26	121	50	27	74	124	98	30	122	127	146	33	170	130
3	36	27	133	51	39	75	136	99	42	123	139	147	45	171	142
4	48	28	145	52	51	76	148	100	54	124	151	148	57	172	154
5	60	29	157	53	63	77	160	101	66	125	163	149	69	173	166
6	72	30	169	54	75	78	172	102	78	126	175	150	81	174	178
7	84	31	181	55	87	79	184	103	90	127	187	151	93	175	190
8	96	32	2	56	99	80	5	104	102	128	8	152	105	176	11
9	108	33	14	57	111	81	17	105	114	129	20	153	117	177	23
10	120	34	26	58	123	82	29	106	126	130	32	154	129	178	35
11	132	35	38	59	135	83	41	107	138	131	44	155	141	179	47
12	144	36	50	60	147	84	53	108	150	132	56	156	153	180	59
13	156	37	62	61	159	85	65	109	162	133	68	157	165	181	71
14	168	38	74	62	171	86	77	110	174	134	80	158	177	182	83
15	180	39	86	63	183	87	89	111	186	135	92	159	189	183	95
16	1	40	98	64	4	88	101	112	7	136	104	160	10	184	107
17	13	41	110	65	16	89	113	113	19	137	116	161	22	185	119
18	25	42	122	66	28	90	125	114	31	138	128	162	34	186	131
19	37	43	134	67	40	91	137	115	43	139	140	163	46	187	143
20	49	44	146	68	52	92	149	116	55	140	152	164	58	188	155
21	61	45	158	69	64	93	161	117	67	141	164	165	70	189	167
22	73	46	170	70	76	94	173	118	79	142	176	166	82	190	179
23	85	47	182	71	88	95	185	119	91	143	188	167	94	191	191

G.6.3 Mapping into symbols

The frequency domain symbols are generated by grouping 4 coded bits and mapping into complex 16-QAM symbols according to Table 84. For instance, the first 4 bits (0 1 1 1) are mapped to the complex value, –0.316 + 0.316j, inserted at subcarrier #26.

Four pilot subcarriers are added by taking the values {1.0,1.0,1.0,–1.0}, multiplying them by the second element of sequence p, given in Equation (22), and inserting them into location {–21,–7,7,21}, respectively.

The frequency domain is shown in Table G.22.

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Table G.20—Second permutation

i	*j*	*i*	*j*	*i*	*j*	*i*	*j*	*i*	*j*	*i*	*j*	*i*	*j*	*i*	*j*
0	0	24	24	48	48	72	72	96	96	120	120	144	144	168	168
1	1	25	25	49	49	73	73	97	97	121	121	145	145	169	169
2	2	26	26	50	50	74	74	98	98	122	122	146	146	170	170
3	3	27	27	51	51	75	75	99	99	123	123	147	147	171	171
4	4	28	28	52	52	76	76	100	100	124	124	148	148	172	172
5	5	29	29	53	53	77	77	101	101	125	125	149	149	173	173
6	6	30	30	54	54	78	78	102	102	126	126	150	150	174	174
7	7	31	31	55	55	79	79	103	103	127	127	151	151	175	175
8	8	32	32	56	56	80	80	104	104	128	128	152	152	176	176
9	9	33	33	57	57	81	81	105	105	129	129	153	153	177	177
10	10	34	34	58	58	82	82	106	106	130	130	154	154	178	178
11	11	35	35	59	59	83	83	107	107	131	131	155	155	179	179
12	13	36	37	60	61	84	85	108	109	132	133	156	157	180	181
13	12	37	36	61	60	85	84	109	108	133	132	157	156	181	180
14	15	38	39	62	63	86	87	110	111	134	135	158	159	182	183
15	14	39	38	63	62	87	86	111	110	135	134	159	158	183	182
16	17	40	41	64	65	88	89	112	113	136	137	160	161	184	185
17	16	41	40	65	64	89	88	113	112	137	136	161	160	185	184
18	19	42	43	66	67	90	91	114	115	138	139	162	163	186	187
19	18	43	42	67	66	91	90	115	114	139	138	163	162	187	186
20	21	44	45	68	69	92	93	116	117	140	141	164	165	188	189
21	20	45	44	69	68	93	92	117	116	141	140	165	164	189	188
22	23	46	47	70	71	94	95	118	119	142	143	166	167	190	191
23	22	47	46	71	70	95	94	119	118	143	142	167	166	191	190

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Table G.21—Interleaved bits of first DATA symbol

##	Bit	##	Bit	##	Bit	##	Bit	##	Bit	##	Bit
0	0	32	0	64	0	96	0	128	0	160	0
1	1	33	1	65	0	97	1	129	0	161	0
2	1	34	1	66	0	98	1	130	0	162	0
3	1	35	1	67	1	99	0	131	1	163	0
4	0	36	0	68	0	100	1	132	1	164	0
5	1	37	0	69	0	101	1	133	0	165	0
6	1	38	1	70	0	102	1	134	1	166	0
7	1	39	1	71	0	103	0	135	1	167	0
8	1	40	0	72	1	104	0	136	0	168	0
9	1	41	0	73	0	105	0	137	1	169	0
10	1	42	0	74	0	106	1	138	1	170	0
11	1	43	0	75	1	107	1	139	0	171	0
12	0	44	0	76	1	108	1	140	1	172	1
13	0	45	0	77	0	109	0	141	0	173	1
14	0	46	0	78	1	110	0	142	1	174	0
15	0	47	0	79	0	111	0	143	1	175	1
16	1	48	1	80	0	112	1	144	1	176	1
17	1	49	0	81	0	113	1	145	0	177	0
18	1	50	1	82	0	114	1	146	0	178	1
19	0	51	1	83	1	115	1	147	1	179	1
20	1	52	1	84	1	116	0	148	1	180	0
21	1	53	1	85	1	117	1	149	0	181	0
22	1	54	1	86	0	118	0	150	0	182	1
23	1	55	1	87	1	119	1	151	0	183	1
24	1	56	0	88	0	120	0	152	0	184	0
25	1	57	0	89	0	121	1	153	1	185	1
26	0	58	0	90	0	122	1	154	0	186	1
27	0	59	1	91	1	123	0	155	0	187	0
28	0	60	0	92	0	124	1	156	0	188	1
29	1	61	0	93	0	125	0	157	0	189	1
30	0	62	0	94	1	126	0	158	1	190	0
31	0	63	1	95	0	127	1	159	1	191	1

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Table G.22—Frequency domain of first DATA symbol

##	Re	Im		##	Re	Im		##	Re	Im		##	Re	Im
–32	0.000	0.000		–16	–0.949	0.316		0	0.000	0.000		16	–0.316	–0.949
–31	0.000	0.000		–15	–0.949	–0.949		1	–0.316	0.949		17	–0.949	0.316
–30	0.000	0.000		–14	–0.949	–0.949		2	0.316	0.949		18	–0.949	–0.949
–29	0.000	0.000		–13	0.949	0.316		3	–0.949	0.316		19	–0.949	–0.949
–28	0.000	0.000		–12	0.316	0.316		4	0.949	–0.949		20	–0.949	–0.949
–27	0.000	0.000		–11	–0.949	–0.316		5	0.316	0.316		21	–1.000	0.000
–26	–0.316	0.316		–10	–0.949	–0.316		6	–0.316	–0.316		22	0.316	–0.316
–25	–0.316	0.316		–9	–0.949	–0.316		7	1.000	0.000		23	0.949	0.316
–24	0.316	0.316		–8	–0.949	–0.949		8	–0.316	0.949		24	–0.949	0.316
–23	–0.949	–0.949		–7	1.000	0.000		9	0.949	–0.316		25	–0.316	0.949
–22	0.316	0.949		–6	0.949	–0.316		10	–0.949	–0.316		26	0.316	–0.316
–21	1.000	0.000		–5	0.949	0.949		11	0.949	0.316		27	0.000	0.000
–20	0.316	0.316		–4	–0.949	–0.316		12	–0.316	0.949		28	0.000	0.000
–19	0.316	–0.949		–3	0.316	–0.316		13	0.949	0.316		29	0.000	0.000
–18	–0.316	–0.949		–2	–0.949	–0.316		14	0.949	–0.316		30	0.000	0.000
–17	–0.316	0.316		–1	–0.949	0.949		15	0.949	–0.949		31	0.000	0.000

The time domain samples are produced by performing IFFT, cyclically extending, and multiplying with the window function in the same manner as described in G.4.5. The time domain samples are appended with one sample overlap to the SIGNAL field symbol.

G.7 Generating the additional DATA symbols

The generation of the additional five data symbols follows the same procedure as described in Clause 5 of IEEE Std 802.11, 1999 Edition. Special attention should be paid to the scrambling of the pilot subcarriers. Table G.23 lists the polarity of the pilot subcarriers and the elements of the sequence $p_{0...126}$ for the DATA symbols. For completeness, the pilots in the SIGNAL are included as well. The symbols are appended one after the other with a one-sample overlap.

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Table G.23—Polarity of the pilot subcarriers

i	OFDM symbol	Element of p_i	Pilot at #-21	Pilot at #-7	Pilot at #7	Pilot at #21
0	SIGNAL	1	1.0 +0 j	1.0 +0 j	1.0 +0 j	–1.0 +0 j
1	DATA 1	1	1.0 +0 j	1.0 +0 j	1.0 +0 j	–1.0 +0 j
2	DATA 2	1	1.0 +0 j	1.0 +0 j	1.0 +0 j	–1.0 +0 j
3	DATA 3	1	1.0 +0 j	1.0 +0 j	1.0 +0 j	–1.0 +0 j
4	DATA 4	–1	–1.0 +0 j	–1.0 +0 j	–1.0 +0 j	1.0 +0 j
5	DATA 5	–1	–1.0 +0 j	–1.0 +0 j	–1.0 +0 j	1.0 +0 j
6	DATA 6	–1	–1.0 +0 j	–1.0 +0 j	–1.0 +0 j	1.0 +0 j

G.8 The entire packet

The packet in its entirety is shown in Table G.24. The short sequences section, the long sequences section, the SIGNAL field, and the DATA symbols are separated by double lines.

Table G.24—The entire packet

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
0	0.023	0.023	40	0.046	0.046	80	0.046	0.046	120	0.046	0.046
1	–0.132	0.002	41	0.002	–0.132	81	–0.132	0.002	121	0.002	–0.132
2	–0.013	–0.079	42	-0.079	–0.013	82	–0.013	–0.079	122	–0.079	–0.013
3	0.143	–0.013	43	-0.013	0.143	83	0.143	–0.013	123	–0.013	0.143
4	0.092	0.000	44	0.000	0.092	84	0.092	0.000	124	0.000	0.092
5	0.143	–0.013	45	–0.013	0.143	85	0.143	–0.013	125	–0.013	0.143
6	–0.013	–0.079	46	–0.079	–0.013	86	–0.013	–0.079	126	–0.079	–0.013
7	–0.132	0.002	47	0.002	–0.132	87	–0.132	0.002	127	0.002	–0.132
8	0.046	0.046	48	0.046	0.046	88	0.046	0.046	128	0.046	0.046
9	0.002	–0.132	49	–0.132	0.002	89	0.002	–0.132	129	–0.132	0.002
10	–0.079	–0.013	50	–0.013	–0.079	90	–0.079	–0.013	130	–0.013	–0.079
11	–0.013	0.143	51	0.143	–0.013	91	–0.013	0.143	131	0.143	–0.013
12	0.000	0.092	52	0.092	0.000	92	0.000	0.092	132	0.092	0.000
13	–0.013	0.143	53	0.143	–0.013	93	–0.013	0.143	133	0.143	–0.013
14	–0.079	–0.013	54	–0.013	–0.079	94	–0.079	–0.013	134	–0.013	–0.079
15	0.002	–0.132	55	–0.132	0.002	95	0.002	–0.132	135	–0.132	0.002
16	0.046	0.046	56	0.046	0.046	96	0.046	0.046	136	0.046	0.046
17	–0.132	0.002	57	0.002	–0.132	97	–0.132	0.002	137	0.002	–0.132

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Table G.24—The entire packet (continued)

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
18	–0.013	–0.079	58	–0.079	–0.013	98	–0.013	–.079	138	–0.079	–0.013
19	0.143	–0.013	59	–0.013	0.143	99	0.143	–0.013	139	–0.013	0.143
20	0.092	0.000	60	0.000	0.092	100	0.092	0.000	140	0.000	0.092
21	0.143	–0.013	61	–0.013	0.143	101	0.143	–0.013	141	–0.013	0.143
22	–0.013	–0.079	62	–0.079	–0.013	102	–0.013	–0.079	142	–0.079	–0.013
23	–0.132	0.002	63	0.002	–0.132	103	–0.132	0.002	143	0.002	–0.132
24	0.046	0.046	64	0.046	0.046	104	0.046	0.046	144	0.046	0.046
25	0.002	–0.132	65	–0.132	0.002	105	0.002	–0.132	145	–0.132	0.002
26	–0.079	–0.013	66	–0.013	–0.079	106	–0.079	–0.013	146	–0.013	–0.079
27	–0.013	0.143	67	0.143	–0.013	107	–0.013	0.143	147	0.143	–0.013
28	0.000	0.092	68	0.092	0.000	108	0.000	0.092	148	0.092	0.000
29	–0.013	0.143	69	0.143	–0.013	109	–0.013	0.143	149	0.143	–0.013
30	–0.079	–0.013	70	–0.013	–0.079	110	–0.079	–0.013	150	–0.013	–0.079
31	0.002	–0.132	71	–0.132	0.002	111	0.002	–0.132	151	–0.132	0.002
32	0.046	0.046	72	0.046	0.046	112	0.046	0.046	152	0.046	0.046
33	–0.132	0.002	73	0.002	–0.132	113	–0.132	0.002	153	0.002	–0.132
34	–0.013	–0.079	74	–0.079	–0.013	114	–0.013	–0.079	154	–0.079	–0.013
35	0.143	–0.013	75	–0.013	0.143	115	0.143	–0.013	155	–0.013	0.143
36	0.092	0.000	76	0.000	0.092	116	0.092	0.000	156	0.000	0.092
37	0.143	–0.013	77	–0.013	0.143	117	0.143	–0.013	157	–0.013	0.143
38	–0.013	–0.079	78	–0.079	–0.013	118	–0.013	–0.079	158	–0.079	–0.013
39	–0.132	0.002	79	0.002	–0.132	119	–0.132	0.002	159	0.002	–0.132
160	–0.055	0.023	200	0.098	–0.026	240	0.062	0.062	280	–0.035	–0.151
161	0.012	–0.098	201	0.053	0.004	241	0.119	0.004	281	–0.122	–0.017
162	0.092	–0.106	202	0.001	–0.115	242	-0.022	–0.161	282	–0.127	–0.021
163	–0.092	–0.115	203	–0.137	–0.047	243	0.059	0.015	283	0.075	–0.074
164	–0.003	–0.054	204	0.024	–0.059	244	0.024	0.059	284	–0.003	0.054
165	0.075	0.074	205	0.059	–0.015	245	–0.137	0.047	285	–0.092	0.115
166	–0.127	0.021	206	–0.022	0.161	246	0.001	0.115	286	0.092	0.106
167	–0.122	0.017	207	0.119	–0.004	247	0.053	–0.004	287	0.012	0.098
168	–0.035	0.151	208	0.062	–0.062	248	0.098	0.026	288	–0.156	0.000
169	–0.056	0.022	209	0.037	0.098	249	–0.038	0.106	289	0.012	–0.098
170	–0.060	–0.081	210	–0.057	0.039	250	–0.115	0.055	290	0.092	–0.106

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Table G.24—The entire packet (continued)

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
171	0.070	–0.014	211	–0.131	0.065	251	0.060	0.088	291	–0.092	–0.115
172	0.082	–0.092	212	0.082	0.092	252	0.021	–0.028	292	–0.003	–0.054
173	–0.131	–0.065	213	0.070	0.014	253	0.097	–0.083	293	0.075	0.074
174	–0.057	–0.039	214	–0.060	0.081	254	0.040	0.111	294	–0.127	0.021
175	0.037	–0.098	215	–0.056	–0.022	255	–0.005	0.120	295	–0.122	0.017
176	0.062	0.062	216	–0.035	–0.151	256	0.156	0.000	296	–0.035	0.151
177	0.119	0.004	217	–0.122	–0.017	257	–0.005	–0.120	297	–0.056	0.022
178	–0.022	–0.161	218	–0.127	–0.021	258	0.040	–0.111	298	–0.060	–0.081
179	0.059	0.015	219	0.075	–0.074	259	0.097	0.083	299	0.070	–0.014
180	0.024	0.059	220	–0.003	0.054	260	0.021	0.028	300	0.082	–0.092
181	–0.137	0.047	221	–0.092	0.115	261	0.060	–0.088	301	–0.131	–0.065
182	0.001	0.115	222	0.092	0.106	262	–0.115	–0.055	302	–0.057	–0.039
183	0.053	–0.004	223	0.012	0.098	263	–0.038	–0.106	303	0.037	–0.098
184	0.098	0.026	224	–0.156	0.000	264	0.098	–0.026	304	0.062	0.062
185	–0.038	0.106	225	0.012	–0.098	265	0.053	0.004	305	0.119	0.004
186	–0.115	0.055	226	0.092	–0.106	266	0.001	–0.115	306	–0.022	–0.161
187	0.060	0.088	227	–0.092	–0.115	267	–0.137	–0.047	307	0.059	0.015
188	0.021	–0.028	228	–0.003	–0.054	268	0.024	–0.059	308	0.024	0.059
189	0.097	–0.083	229	0.075	0.074	269	0.059	–0.015	309	–0.137	0.047
190	0.040	0.111	230	–0.127	0.021	270	–0.022	0.161	310	0.001	0.115
191	–0.005	0.120	231	–0.122	0.017	271	0.119	–0.004	311	0.053	–0.004
192	0.156	0.000	232	–0.035	0.151	272	0.062	–0.062	312	0.098	0.026
193	–0.005	–0.120	233	–0.056	0.022	273	0.037	0.098	313	–0.038	0.106
194	0.040	–0.111	234	–0.060	–0.081	274	–0.057	0.039	314	–0.115	0.055
195	0.097	0.083	235	0.070	–0.014	275	–0.131	0.065	315	0.060	0.088
196	0.021	0.028	236	0.082	–0.092	276	0.082	0.092	316	0.021	–0.028
197	0.060	–0.088	237	–0.131	–0.065	277	0.070	0.014	317	0.097	–0.083
198	–0.115	–0.055	238	–0.057	–0.039	278	–0.060	0.081	318	0.040	0.111
199	–0.038	–0.106	239	0.037	–0.098	279	-0.056	–0.022	319	–0.005	0.120
320	0.109	0.000	340	0.010	–0.097	360	–0.035	0.044	380	–0.051	0.202
321	0.033	–0.044	341	–0.060	–0.124	361	0.017	–0.059	381	0.035	–0.116
322	–0.002	–0.038	342	–0.033	–0.044	362	0.053	–0.017	382	0.016	–0.174
323	–0.081	0.084	343	0.011	0.002	363	0.099	0.100	383	0.057	–0.052

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Table G.24—The entire packet (continued)

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
324	0.007	–0.100	344	0.098	0.044	364	0.034	–0.148	384	0.062	0.000
325	–0.001	–0.113	345	0.136	0.105	365	–0.003	–0.094	385	0.033	–0.044
326	–0.021	–0.005	346	–0.021	0.005	366	–0.120	0.042	386	–0.002	–0.038
327	0.136	–0.105	347	–0.001	0.113	367	–0.136	–0.070	387	–0.081	0.084
328	0.098	–0.044	348	0.007	0.100	368	–0.031	0.000	388	0.007	–0.100
329	0.011	–0.002	349	–0.081	–0.084	369	–0.136	0.070	389	–0.001	–0.113
330	–0.033	0.044	350	–0.002	0.038	370	–0.120	–0.042	390	–0.021	–0.005
331	–0.060	0.124	351	0.033	0.044	371	–0.003	0.094	391	0.136	–0.105
332	0.010	0.097	352	0.062	0.000	372	0.034	0.148	392	0.098	–0.044
333	0.000	–0.008	353	0.057	0.052	373	0.099	–0.100	393	0.011	–0.002
334	0.018	–0.083	354	0.016	0.174	374	0.053	0.017	394	–0.033	0.044
335	–0.069	0.027	355	0.035	0.116	375	0.017	0.059	395	–0.060	0.124
336	–0.219	0.000	356	–0.051	–0.202	376	–0.035	–0.044	396	0.010	0.097
337	–0.069	–0.027	357	0.011	0.036	377	–0.049	0.008	397	0.000	–0.008
338	0.018	0.083	358	0.089	0.209	378	0.089	–0.209	398	0.018	–0.083
339	0.000	0.008	359	–0.049	–0.008	379	0.011	–0.036	399	–0.069	0.027
400	–0.149	0.035	420	–0.168	–0.043	440	–0.017	0.019	460	0.046	0.023
401	–0.109	–0.130	421	–0.066	0.028	441	–0.016	–0.074	461	–0.050	0.034
402	0.003	–0.011	422	–0.065	0.037	442	–0.005	–0.085	462	–0.024	–0.009
403	–0.003	0.083	423	0.039	0.025	443	0.066	0.062	463	0.065	0.166
404	–0.039	–0.032	424	0.078	–0.045	444	0.154	0.050	464	–0.079	0.071
405	0.051	0.048	425	–0.105	0.048	445	0.120	–0.001	465	–0.109	–0.130
406	0.136	0.173	426	–0.030	0.093	446	–0.015	0.087	466	0.003	–0.011
407	0.047	–0.033	427	0.020	–0.086	447	0.141	0.013	467	–0.003	0.083
408	–0.042	–0.039	428	0.005	0.052	448	0.236	0.049	468	–0.039	–0.032
409	–0.071	–0.005	429	–0.014	–0.084	449	–0.025	0.067	469	0.051	0.048
410	–0.095	–0.100	430	–0.146	–0.050	450	–0.099	0.007	470	0.136	0.173
411	–0.111	–0.009	431	–0.053	0.277	451	0.022	–0.017	471	0.047	–0.033
412	–0.047	–0.086	432	–0.020	–0.011	452	0.078	–0.116	472	–0.042	–0.039
413	0.042	–0.123	433	–0.066	0.002	453	0.015	–0.092	473	–0.071	–0.005
414	–0.034	–0.095	434	0.140	0.007	454	–0.051	–0.054	474	–0.095	–0.100
415	0.012	–0.076	435	0.081	–0.144	455	0.019	0.011	475	–0.111	–0.009
416	0.061	0.049	436	–0.108	0.152	456	0.020	0.065	476	–0.047	–0.086

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Table G.24—The entire packet (continued)

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
417	–0.034	–0.048	437	0.024	–0.024	457	–0.012	0.038	477	0.042	–0.123
418	0.096	–0.015	438	0.040	–0.168	458	–0.009	0.024	478	–0.034	–0.095
419	0.018	0.042	439	–0.057	0.055	459	0.009	–0.052	479	0.012	–0.076
480	–0.004	0.075	500	–0.011	0.061	520	–0.081	0.067	540	0.114	–0.007
481	–0.034	0.026	501	–0.028	0.060	521	–0.043	–0.139	541	0.131	0.015
482	0.011	–0.021	502	–0.111	–0.057	522	–0.084	–0.194	542	0.067	–0.017
483	0.046	–0.011	503	0.049	0.010	523	0.004	0.027	543	–0.047	–0.017
484	0.035	–0.141	504	0.140	–0.006	524	–0.083	–0.098	544	–0.069	0.100
485	0.074	–0.002	505	0.069	–0.114	525	0.037	–0.080	545	–0.034	0.026
486	0.096	0.168	506	0.014	–0.002	526	0.059	0.120	546	0.011	–0.021
487	0.044	–0.037	507	0.032	–0.048	527	–0.126	–0.082	547	0.046	–0.011
488	0.061	–0.047	508	0.149	–0.064	528	–0.011	–0.138	548	0.035	–0.141
489	0.037	0.130	509	0.070	0.001	529	–0.096	–0.108	549	0.074	–0.002
490	–0.009	0.054	510	0.006	0.006	530	–0.119	–0.015	550	0.096	0.168
491	–0.062	–0.064	511	0.067	0.080	531	0.027	0.142	551	0.044	–0.037
492	–0.101	–0.029	512	0.049	0.038	532	–0.045	–0.143	552	0.061	–0.047
493	0.011	0.024	513	–0.019	0.095	533	0.001	–0.185	553	0.037	0.130
494	0.031	–0.019	514	–0.077	0.203	534	–0.016	0.047	554	–0.009	0.054
495	0.007	0.042	515	0.030	0.063	535	–0.037	–0.054	555	–0.062	–0.064
496	–0.008	0.079	516	0.021	–0.054	536	–0.002	–0.092	556	–0.101	–0.029
497	–0.036	–0.007	517	–0.017	–0.047	537	–0.157	0.014	557	0.011	0.024
498	0.054	0.090	518	0.026	–0.011	538	–0.107	0.121	558	0.031	–0.019
499	0.017	0.109	519	–0.125	0.048	539	0.074	0.108	559	0.007	0.042
560	–0.039	0.050	580	–0.043	–0.040	600	–0.101	0.058	620	0.054	–0.070
561	–0.052	0.072	581	–0.053	0.047	601	0.027	–0.106	621	–0.003	0.034
562	0.041	0.019	582	0.112	–0.104	602	0.138	0.016	622	0.014	0.042
563	–0.084	0.178	583	–0.031	–0.081	603	–0.021	0.061	623	0.106	–0.146
564	–0.020	0.012	584	–0.009	0.024	604	0.046	–0.140	624	–0.069	0.021
565	-0.021	–0.072	585	0.087	0.081	605	–0.003	–0.055	625	–0.052	0.072
566	0.040	0.056	586	–0.003	0.075	606	–0.082	0.019	626	0.041	0.019
567	0.106	0.020	587	–0.023	0.000	607	–0.035	–0.040	627	–0.084	0.178
568	–0.057	0.041	588	0.050	0.109	608	–0.002	–0.049	628	–0.020	0.012
569	0.078	–0.058	589	0.115	0.164	609	0.117	–0.087	629	–0.021	–0.072

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Table G.24—The entire packet (continued)

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
570	0.048	–0.088	590	0.004	0.068	610	0.028	0.031	630	0.040	0.056
571	–0.063	0.046	591	–0.014	–0.011	611	–0.035	0.139	631	0.106	0.020
572	0.087	–0.018	592	0.010	0.018	612	0.053	0.063	632	–0.057	0.041
573	0.003	–0.051	593	–0.010	0.151	613	0.000	–0.022	633	0.078	–0.058
574	–0.027	0.011	594	0.066	0.048	614	–0.083	–0.025	634	0.048	–0.088
575	–0.056	–0.015	595	0.077	–0.146	615	–0.149	0.091	635	–0.063	0.046
576	–0.058	–0.148	596	0.169	–0.074	616	–0.109	0.036	636	0.087	–0.018
577	0.086	–0.049	597	0.009	–0.011	617	–0.063	–0.195	637	0.003	–0.051
578	0.067	0.176	598	–0.215	–0.066	618	–0.149	–0.119	638	–0.027	0.011
579	0.081	0.009	599	–0.084	0.038	619	–0.090	0.016	639	–0.056	–0.015
640	–0.078	–0.134	660	–0.003	–0.024	680	0.003	0.002	700	–0.156	–0.061
641	0.019	–0.081	661	0.114	0.048	681	0.030	–0.035	701	–0.141	–0.086
642	0.077	0.103	662	0.001	–0.009	682	–0.007	–0.050	702	0.002	0.014
643	0.076	0.047	663	–0.039	0.052	683	–0.033	0.002	703	–0.055	0.054
644	0.066	0.062	664	0.011	0.053	684	–0.018	0.020	704	–0.099	–0.120
645	0.070	0.129	665	–0.087	–0.081	685	–0.005	–0.051	705	0.019	–0.081
646	–0.049	0.031	666	–0.037	0.133	686	0.020	–0.044	706	0.077	0.103
647	–0.079	–0.060	667	0.060	–0.052	687	0.105	0.031	707	0.076	0.047
648	0.056	0.116	668	–0.150	–0.133	688	0.041	0.059	708	0.066	0.062
649	0.051	0.205	669	–0.067	0.068	689	0.052	0.033	709	0.070	0.129
650	0.093	0.056	670	0.167	–0.144	690	0.053	0.134	710	–0.049	0.031
651	0.115	0.020	671	0.011	–0.030	691	–0.010	0.071	711	–0.079	–0.060
652	0.047	–0.103	672	–0.040	–0.038	692	0.162	–0.147	712	0.056	0.116
653	–0.009	–0.067	673	–0.066	–0.182	693	0.076	–0.090	713	0.051	0.205
654	–0.122	0.060	674	–0.051	0.059	694	–0.030	–0.101	714	0.093	0.056
655	–0.062	–0.014	675	0.031	0.016	695	0.089	0.027	715	0.115	0.020
656	0.018	0.099	676	–0.186	–0.010	696	–0.070	0.223	716	0.047	–0.103
657	0.031	0.060	677	–0.117	–0.030	697	–0.109	0.003	717	–0.009	–0.067
658	0.068	–0.014	678	0.090	–0.202	698	0.042	–0.025	718	–0.122	0.060
659	–0.038	0.028	679	–0.002	–0.094	699	–0.009	0.058	719	–0.062	–0.014
720	0.123	–0.006	740	0.010	0.072	760	0.069	–0.009	780	–0.051	0.062
721	–0.050	–0.133	741	–0.023	0.011	761	–0.085	0.088	781	–0.053	–0.049
722	–0.106	–0.025	742	0.097	0.073	762	–0.104	–0.128	782	–0.155	–0.047

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Table G.24—The entire packet (continued)

##	Re	Im	##	Re	Im	##	Re	Im	##	Re	Im
723	0.056	0.007	743	0.046	0.052	763	0.041	–0.100	783	0.049	0.004
724	0.083	–0.023	744	–0.071	–0.112	764	0.011	0.145	784	0.227	–0.110
725	0.054	–0.110	745	0.014	0.072	765	–0.046	0.033	785	–0.050	–0.133
726	–0.043	–0.130	746	–0.116	0.063	766	–0.051	–0.049	786	–0.106	–0.025
727	0.020	–0.080	747	–0.186	–0.092	767	0.018	0.066	787	0.056	0.007
728	0.010	–0.090	748	–0.024	–0.047	768	0.031	–0.010	788	0.083	–0.023
729	–0.181	–0.004	749	0.074	–0.017	769	–0.060	–0.056	789	0.054	–0.110
730	–0.043	–0.013	750	0.072	0.020	770	0.002	0.012	790	–0.043	–0.130
731	0.127	–0.095	751	–0.037	–0.021	771	0.056	0.010	791	0.020	–0.080
732	0.025	0.037	752	0.049	0.011	772	0.033	0.122	792	0.010	–0.090
733	–0.077	0.009	753	0.080	–0.054	773	–0.010	0.159	793	–0.181	–0.004
734	–0.084	–0.008	754	–0.088	–0.162	774	–0.056	0.006	794	–0.043	–0.013
735	–0.070	0.107	755	0.004	0.113	775	0.057	–0.050	795	0.127	–0.095
736	–0.071	0.030	756	0.071	0.105	776	0.071	–0.026	796	0.025	0.037
737	0.013	0.082	757	0.034	–0.036	777	–0.001	0.005	797	–0.077	0.009
738	0.062	0.068	758	0.063	0.136	778	0.076	0.028	798	–0.084	–0.008
739	0.042	–0.016	759	0.075	0.033	779	0.018	0.062	799	–0.070	0.107
800	–0.021	0.004	820	0.067	–0.189	840	–0.006	0.026	860	–0.013	0.079
801	0.082	–0.011	821	0.119	–0.070	841	0.009	0.080	861	0.031	0.029
802	–0.002	0.022	822	0.020	0.105	842	0.085	0.017	862	0.061	–0.015
803	0.123	–0.056	823	0.008	0.057	843	–0.155	0.095	863	–0.172	–0.015
804	–0.016	0.019	824	0.034	0.040	844	–0.010	0.084	864	0.030	–0.021
805	–0.091	0.013	825	–0.003	–0.003	845	0.145	0.012	865	0.082	–0.011
806	–0.048	–0.216	826	–0.042	0.043	846	0.064	–0.053	866	–0.002	0.022
807	–0.060	–0.079	827	–0.068	0.060	847	–0.011	–0.081	867	0.123	–0.056
808	–0.092	0.112	828	–0.058	–0.107	848	–0.048	–0.020	868	–0.016	0.019
809	0.026	–0.011	829	0.067	0.046	849	0.116	–0.008	869	–0.091	0.013
810	0.215	–0.037	830	0.069	0.086	850	0.057	–0.002	870	–0.048	–0.216
811	0.010	–0.009	831	0.010	–0.140	851	0.008	–0.059	871	–0.060	–0.079

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Table G.24—The entire packet (continued)

##	Re	Im		##	Re	Im		##	Re	Im		##	Re	Im
812	–0.117	–0.056		832	–0.049	0.002		852	0.049	–0.030		872	–0.092	0.112
813	–0.015	–0.081		833	–0.115	–0.016		853	–0.033	0.053		873	0.026	–0.011
814	–0.015	–0.125		834	–0.028	–0.027		854	–0.023	–0.139		874	0.215	–0.037
815	0.009	–0.119		835	–0.024	0.231		855	–0.118	–0.108		875	0.010	–0.009
816	–0.011	–0.079		836	0.019	0.042		856	0.065	0.098		876	–0.117	–0.056
817	–0.010	–0.053		837	0.013	–0.002		857	0.132	0.022		877	–0.015	–0.081
818	–0.071	0.058		838	–0.049	0.199		858	–0.135	0.084		878	–0.015	–0.125
819	–0.116	0.010		839	0.096	0.037		859	–0.015	0.175		879	0.009	–0.119
												880	–0.006	–0.039

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EXHIBIT B

Standards

802.11g-2003 - IEEE Standard for Information technology-- Local and metropolitan area networks-- Specific requirements-- Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Further Higher Data Rate Extension in the 2.4 GHz Band

Publisher: IEEE Cite This PDF

Status: Superseded Versions Amendments Available

124 Cites in Papers
34 Cites in Patents
6402 Full Text Views

Abstract
Figures
Citations
Keywords
Definitions
Metrics
Versions
Amendments
Footnotes

Abstract:
Changes and additions to IEEE Std 802.11, 1999 Edition, as amended by IEEE Stds 802.11a-1999, 802.11b-1999, 802.11b-1999/Cor 1-2001, and 802.11d-2001, are provided to support the further higher data rate extension for operation in the 2.4 GHz band

Scope:
To develop a higher speed(s) PHY extension to 802.11b.

Purpose:
To develop a new PHY extension to enhance the performance and the possible applications of the 802.11b compatible networks by increasing the data rate achievable by such devices. This technology will be beneficial for improved access to fixed network LAN and inter-network infrastructure (including access to other wireless LANs) via a network of access points, as well as creation of higher performance ad hoc networks.

Date of Publication: 27 June 2003

Electronic ISBN:978-0-7381-3701-8

DOI: 10.1109/IEEESTD.2003.94282

ICS Code: 35.100.10 35.110 35.100.20 - Physical layer Networking Data link layer

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IEEE Standards

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(Amendment to IEEE Std 802.11™, 1999 Edition (Reaff 2003)
as amended by
IEEE Stds 802.11a™-1999, 802.11b™-1999,
802.11b™-1999/Cor 1-2001, and 802.11d™-2001)

802.11g™

IEEE Standard for Information technology—

Telecommunications and information exchange between systems—

Local and metropolitan area networks—

Specific requirements

Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications

Amendment 4: Further Higher Data Rate Extension in the 2.4 GHz Band

IEEE Computer Society

Sponsored by the
LAN/MAN Standards Committee

This amendment is an approved IEEE Standard. It will be incorporated into the base standard in a future edition.



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IEEE Std 802.11g™-2003
[Amendment to IEEE Std 802.11™, 1999 Edition (Reaff 2003)
as amended by
IEEE Stds 802.11a™-1999, 802.11b™-1999,
802.11b™-1999/Cor 1-2001, and 802.11d™-2001]

IEEE Standard for
Information technology—
Telecommunications and information exchange between systems—
Local and metropolitan area networks—
Specific requirements

Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications

Amendment 4: Further Higher Data Rate Extension in the 2.4 GHz Band

Sponsor

LAN/MAN Standards Committee
of the
IEEE Computer Society

Approved 12 June 2003

IEEE-SA Standards Board

Abstract: Changes and additions to IEEE Std 802.11, 1999 Edition, as amended by IEEE Stds 802.11a-1999, 802.11b-1999, 802.11b-1999/Cor 1-2001, and 802.11d-2001, are provided to support the further higher data rate extension for operation in the 2.4 GHz band.

Keywords: LAN, local area network, radio frequency, wireless

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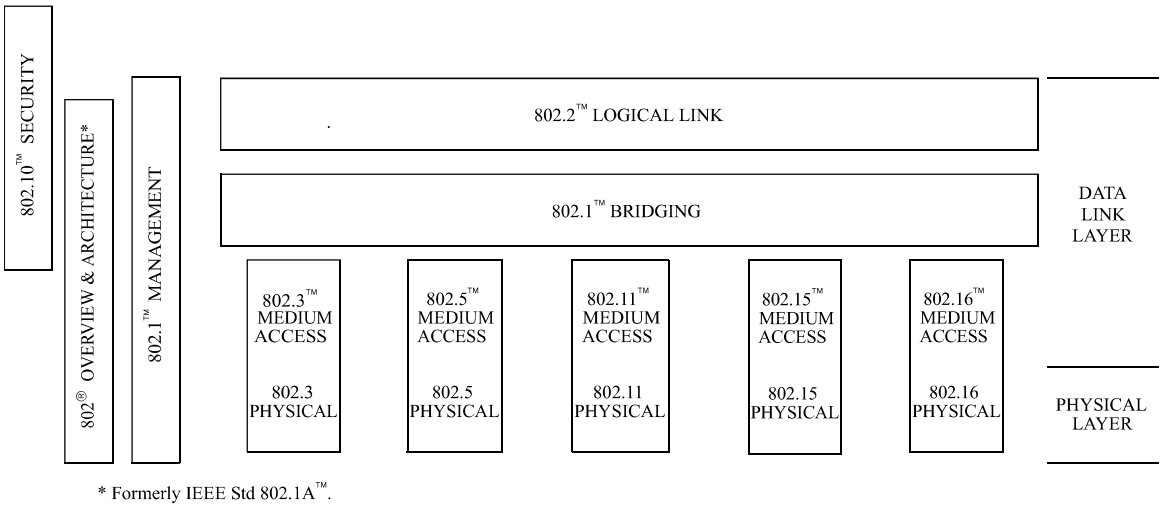
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Introduction

This introduction is not part of IEEE Std 802.11g-2003 (Amendment to IEEE Std 802.11, 1999 Edition, as amended by IEEE Stds 802.11a-1999, 802.11b-1999, 802.11b-1999/Cor 1-2001, and 802.11d-2001), IEEE Standard for Information Technology—Telecommunications and Information Exchange between Systems—Local and Metropolitan Area Networks—Specific Requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications—Amendment 4: Further Higher Data Rate Extension in the 2.4 GHz Band.

This amendment is part of a family of standards for local and metropolitan area networks. The relationship between the standard and other members of the family is shown below. (The numbers in the figure refer to IEEE standard designations.[1])



* Formerly IEEE Std 802.1A™.

This family of standards deals with the Physical and Data Link layers as defined by the International Organization for Standardization (ISO) Open Systems Interconnection (OSI) Basic Reference Model (ISO/IEC 7498-1: 1994). The access standards define five types of medium access technologies and associated physical media, each appropriate for particular applications or system objectives. Some access standards have been withdrawn and other types are under investigation.

The standards defining the technologies noted above are as follows:

- IEEE Std 802:[2] *Overview and Architecture.* This standard provides an overview to the family of IEEE 802 Standards.
- IEEE Std 802.1B™ and 802.1k™ [ISO/IEC 15802-2] *LAN/MAN Management.* Defines an OSI management-compatible architecture and services and protocol elements for use in a LAN/MAN environment for performing remote management.
- IEEE Std 802.1D™ *Media Access Control (MAC) Bridges.* Specifies an architecture and protocol for the interconnection of IEEE 802 LANs below the MAC service boundary.

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[2]The IEEE 802 Overview and Architecture Specification, originally known as IEEE Std 802.1A, has been renumbered as IEEE Std 802. This has been done to accommodate recognition of the base standard in a family of standards. References to IEEE Std 802.1A should be considered as references to IEEE Std 802.

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• IEEE Std 802.1E™ [ISO/IEC 15802-4]	*System Load Protocol.* Specifies a set of services and protocol for those aspects those aspects of management concerned with the loading of systems on IEEE 802 LANs.
• IEEE Std 802.1F™	*Common Definitions and Procedures for IEEE 802 Management Information.*
• IEEE Std 802.1G™ [ISO/IEC 15802-5]:	*Remote Media Access Control (MAC) Bridging.* Specifies extensions for the interconnection, using non-LAN systems communication technologies, of geographically separated IEEE 802 LANs below the level of the logical link control protocol.
• IEEE Std 802.1H™ [ISO/IEC TR 11802-5]	*Recommended Practice for Media Access Control (MAC) Bridging of Ethernet V2.0 in IEEE 802 Local Area Networks.*
• IEEE Std 802.1Q™	*Virtual Bridged Local Area Networks.* Defines an architecture for Virtual Bridged LANs, the services provided in Virtual Bridged LANs, and the protocols and algorithms involved in the provision of those services.
• IEEE Std 802.2 [ISO/IEC 8802-2]	*Logical Link Control.*
• IEEE Std 802.3	*CSMA/CD Access Method and Physical Layer Specifications.*
• IEEE Std 802.5 [ISO/IEC 8802-5]	*Token Ring Access Method and Physical Layer Specifications.*
• IEEE Std 802.10	*Standard for Interoperable LAN Security (SILS).* Currently approved: Secure Data Exchange (SDE).
• IEEE Std 802.11 [ISO/IEC 8802-11]	*Wireless LAN Medium Access Control (MAC) Sublayer and Physical Layer Specifications.*
• IEEE Std 802.15	*Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for: Wireless Personal Area Networks.*
• IEEE Std 802.16	*Air Interface for Fixed Broadband Wireless Access Systems.*

The reader of this standard is urged to become familiar with the complete family of standards.

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IEEE Standard for
Information technology—
Telecommunications and information exchange between systems—
Local and metropolitan area networks—
Specific requirements

Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications

Amendment 4: Further Higher Data Rate Extension in the 2.4 GHz Band

[This amendment is based on IEEE Std 802.11™-1999 (Reaff 2003), as amended by IEEE Stds 802.11a™-1999, 802.11b™-1999, 802.11b-1999/Cor 1-2001, and 802.11d™-2001.]

NOTE—The editing instructions contained in this amendment define how to merge the material contained herein into the existing base standard and its amendments to form the comprehensive standard.

The editing instructions are shown in ***bold italic***. Four editing instructions are used: change, delete, insert, and replace. ***Change*** is used to make small corrections in existing text or tables. The editing instruction specifies the location of the change and describes what is being changed either by using ~~strikethrough~~ (to remove old material) or underscore (to add new material). ***Delete*** removes existing material. ***Insert*** adds new material without disturbing the existing material. Insertions may require renumbering. If so, renumbering instructions are given in the editing instructions. ***Replace*** is used to make large changes in existing text, subclauses, tables, or figures by removing existing material and replacing it with new material. Editorial notes will not be carried over into future editions.

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3. Definitions

Insert additional definitions after 3.40 and renumber appropriately as follows:

3.41 protection mechanism: Any procedure that attempts to update the NAV of all receiving STAs prior to the transmission of a frame that may or may not be understood by receivers.

3.42 protection mechanism frame: Any frame that is sent as part of a protection mechanism procedure.

4. Abbreviations and acronyms

Insert the following abbreviations alphabetically in the list in Clause 4:

DSSS-OFDM	PHYs using DSSS-OFDM modulation under 19.7 rules
ERP	extended rate PHYs conforming to Clause 19
ERP-PBCC	PHYs using extended rate PBCC modulation under 19.6 rules
ERP-CCK	PHYs using CCK modulation under Clause 19 rules
ERP-DSSS	PHYs using DSSS modulation under Clause 19 rules
ERP-DSSS/CCK	PHYs using DSSS or CCK modulation under Clause 19 rules
ERP-OFDM	PHYs using OFDM modulation under 19.5 rules
EVM	error vector magnitude
NonERP	non-extended rate PHYs conforming to Clause 15 or Clause 18, but not to Clause 19

7. Frame formats

7.2 Format of individual frame types

7.2.1 Control frames

7.2.1.2 CTS frame format

Insert the following paragraph at the end of 7.2.1.2

If the CTS is the first frame in the exchange and the pending data or management frame requires acknowledgment, the duration value is the time, in microseconds, required to transmit the pending data or management frame, plus one SIFS interval, one ACK frame, and an additional SIFS interval. If the CTS is the first frame in the exchange and the pending data or management frame does not require acknowledgment, the duration value is the time, in microseconds, required to transmit the pending data or management frame, plus one SIFS interval. If the calculated duration includes a fractional microsecond, that value is rounded to the next higher integer.

7.2.3 Management frames

Insert the following sentence after the last paragraph:

Gaps may exist in the ordering of fixed fields and elements within frames. The order that remains shall be ascending.

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7.2.3.1 Beacon frame format

Change the note in row 7 of Table 5:

Table 5—Beacon frame body

Order	Information	Notes
7	DS Parameter Set	The DS Parameter Set information element is present within Beacon frames generated by STAs using ~~direct sequence~~ Clause 15, Clause 18, and Clause 19 PHYs.

Insert the following rows in Table 5:

Table 5—Beacon frame body

Order	Information	Notes
19	ERP Information	The ERP Information element is present within Beacon frames generated by STAs using ERP PHYs and is optionally present in other cases.
20	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.

7.2.3.4 Association Request frame format

Insert the following row in Table 7:

Table 7—Association Request frame body

Order	Information	Notes
5	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.

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7.2.3.5 Association Response frame format

Insert the following row in Table 8:

Table 8—Association Response frame body

Order	Information	Notes
5	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.

7.2.3.6 Reassociation Request frame format

Insert the following row in Table 9:

Table 9—Reassociation Request frame body

Order	Information	Notes
6	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.

7.2.3.7 Reassociation Response frame format

Insert the following row in Table 10:

Table 10—Reassociation Response frame body

Order	Information	Notes
5	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.

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7.2.3.8 Probe Request frame format

Insert the following row in Table 11:

Table 11—Probe Request frame body

Order	Information	Notes
4	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.

7.2.3.9 Probe Response frame format

Change row 7 of Table 12 as shown:

Table 12—Probe Response frame body

Order	Information	Notes
7	DS Parameter Set	The DS Parameter Set information element is present within Beacon frames generated by STAs using ~~direct sequence~~ Clause 15, Clause 18, and Clause 19 PHYs.

Insert the following rows in Table 12:

Table 12—Probe Response frame body

Order	Information	Notes
18	ERP Information	ERP Information element is present within Probe Response frames generated by STAs using ERP PHYs and is optionally present in other cases.
19	Extended Supported Rates	The Extended Supported Rates element is present whenever there are more than eight supported rates, and it is optional otherwise.

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7.3 Management frame body components

7.3.1 Fixed fields

7.3.1.4 Capability Information field

Change the first and second paragraphs in 7.3.1.4 as shown:

The Capability Information field contains a number of subfields that are used to indicate requested or advertised optional capabilities.

The length of the Capability Information field is 2 octets. The Capability Information field consists of the following subfields: ESS, IBSS, CF-Pollable, CF-Poll Request, Privacy, Short Preamble, Packet Binary Convolutional Code (PBCC), ~~and~~ Channel Agility, Short Slot Time, and DSSS-OFDM. The format of the Capability Information field is illustrated in Figure 27. No subfield is supplied for ERP as a STA supports ERP operation if it includes all of the Clause 19 mandatory rates in its supported rate set.

Replace Figure 27 with the following:

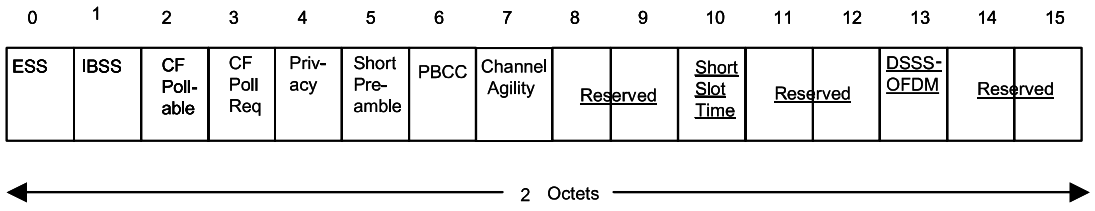


Figure 27—Capability Information fixed field

Change the ninth paragraph in 7.3.1.4 and insert text following the paragraph as shown:

APs (as well as STAs in IBSSs) shall set the Short Preamble subfield to 1 in transmitted Beacon, Probe Response, Association Response, and Reassociation Response management MMPDUs to indicate that the use of the Short Preamble ~~option~~, as described in 18.2.2.2, is allowed within this BSS. To indicate that the use of the Short Preamble ~~option~~ is not allowed, the Short Preamble subfield shall be set to 0 in Beacon, Probe Response, Association Response, and Reassociation Response management MMPDUs transmitted within the BSS.

Insert the following text following the ninth paragraph in 7.3.1.4:

ERP STAs shall set the MIB variable dot11ShortPreambleOptionImplemented to true as all ERP STAs support both long and short preamble formats.

Change the eleventh paragraph in 7.3.1.4 as shown:

APs (as well as STAs in IBSSs) shall set the PBCC subfield to 1 in transmitted Beacon, Probe Response, Association Response, and Reassociation Response management MMPDUs to indicate that the ~~use of the~~ PBCC Modulation option, as described in 18.4.6.6 and 19.6, is allowed within the BSS. To indicate that the ~~use of the~~ PBCC Modulation option is not allowed, the PBCC subfield shall be set to 0 in Beacon, Probe Response, Association Response, and Reassociation Response management MMPDUs transmitted within the BSS.

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Change the thirteenth paragraph in 7.3.1.4 as shown:

Bit 7 of the Capability Information field shall be used to indicate Channel Agility capability by the High Rate direct sequence spread spectrum (HR/DSSS) or ERP PHYs. STAs shall set the Channel Agility bit to 1 when Channel Agility is in use and shall set it to 0 otherwise.

Insert the following paragraphs before the last paragraph of 7.3.1.4:

STAs shall set the Short Slot Time subfield to 1 in transmitted Association Request and Reassociation Request MMPDUs when the MIB attribute dot11ShortSlotTimeOptionImplemented and dot11ShortSlotTimeOptionEnabled are true. Otherwise, the STA shall set the Short Slot Time subfield to 0 in transmitted Association Request and Reassociation Request MMPDUs.

If a STA that does not support Short Slot Time associates, the AP shall use long slot time beginning at the first Beacon subsequent to the association of the long slot time STA. APs shall set the Short Slot Time subfield in transmitted Beacon, Probe Response, Association Response, and Reassociation Response MMPDUs to indicate the currently used slot time value within this BSS.

STAs shall set the MAC variable aSlotTime to the short slot value upon transmission or reception of Beacon, Probe Response, Association Response, and Reassociation Response MMPDUs from the BSS that the STA has joined or started and that have the short slot subfield set to 1 when the MIB attribute dot11ShortSlotTimeOptionImplemented is true. STAs shall set the MAC variable aSlotTime to the long slot value upon transmission or reception of Beacon, Probe Response, Association Response, and Reassociation Response MMPDUs from the BSS that the STA has joined or started and that have the short slot subfield set to 0 when the MIB attribute dot11ShortSlotTimeOptionImplemented is true. STAs shall set the MAC variable aSlotTime to the long slot value at all times when the MIB attribute dot11ShortSlotTimeOptionImplemented is false. When the dot11ShortSlotTimeOptionImplemented MIB attribute is not present, or when the PHY supports only a single slot time value, then the STA shall set the MAC variable aSlotTime to the slot value appropriate for the attached PHY.

For IBSS, the Short Slot Time subfield shall be set to 0.

APs as well as STAs in IBSSs shall set the DSSS-OFDM subfield to 1 in transmitted Beacon, Probe Response, Association Response, and Reassociation Response management MMPDUs to indicate that the use of DSSS-OFDM, as described in 19.7, is allowed within this BSS or by STAs that want to use DSSS-OFDM within an IBSS. To indicate that the use of DSSS-OFDM is not allowed, the DSSS-OFDM subfield shall be set to 0 in Beacon, Probe Response, Association Response, and Reassociation Response MMPDUs transmitted within the BSS.

STAs shall set the DSSS-OFDM subfield to 1 in transmitted Association Request and Reassociation Request MMPDUs when the MIB attribute dot11DSSS-OFDMOptionImplemented and dot11DSSS-OFDMOptionEnabled are true. Otherwise, STAs shall set the DSSS-OFDM subfield to 0 in transmitted Association Request and Reassociation Request MMPDUs.

Change the last paragraph in 7.3.1.4 as shown:

Unused bits ~~8-15~~ of the Capability Information field are reserved.

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7.3.1.9 Status code field

Replace the last row in Table 19 with the following:

Table 19—Status codes

Status code	Meaning
22–24	Reserved
25	Association denied due to requesting station not supporting the Short Slot Time option
26	Association denied due to requesting station not supporting the DSSS-OFDM option
27–65 535	Reserved

7.3.2 Information elements

Replace the last row of Table 20 with the following:

Table 20—Element IDs

Information element	Element ID
Reserved	17–41
ERP Information	42
Reserved	43–49
Extended Supported Rates	50
Reserved	51–255

7.3.2.2 Supported Rates element

Change the first two paragraphs of 7.3.2.2 as follows:

The Supported Rates element specifies ~~the values~~ up to eight rates in the Operational-Rate-Set parameter, as described in the MLME_Join.request and MLME_Start.request primitives. The information field is encoded as 1 to 8 octets, where each octet describes a single Supported Rate. If the number of rates in the Operational Rate Set exceeds eight, then an Extended Supported Rate element shall be generated to specify the remaining supported rates. The use of the Extended Supported Rates element is optional otherwise.

Within Beacon, Probe Response, Association Response, and Reassociation Response management frames, each Supported Rate belonging to the BSS basic rate set is encoded as an octet with the MSB (bit 7) set to 1 and bits 6 through 0 are set to the appropriate value from the valid range column of the DATA_RATE row of the table in 10.4.4.2 (e.g., a 1 Mbit/s rate belonging to the BSS basic rate set is encoded as X'82'). Rates not belonging to the BSS basic rate set are encoded with the MSB set to 0, and bits 6 through 0 are set to the appropriate value from the valid range column of the DATA_RATE row of the table in 10.4.4.2 (e.g., a 2 Mbit/s rate not belonging to the BSS basic rate set is encoded as X'04'). The MSB of each Supported Rate octet in other management frame types is ignored by receiving STAs.

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Insert the following paragraph at the end of 7.3.2.2:

If the DSSS-OFDM bit is set to 1 in the transmitted Capability Information field of an MMPDU, then any supported rates transmitted in that frame that include rates that are common to both DSSS-OFDM and ERP-OFDM shall be interpreted by receiving and transmitting STA to indicate support for both DSSS-OFDM and ERP-OFDM at the indicated rate. However, if any of those rates are indicated as basic (a rate in the BSSBasicRateSet), then the basic rate designation shall be interpreted by receiving and transmitting STA to apply only for the ERP-OFDM modulation and rate. If the PBCC bit is set to 1 in the transmitted capability field of an MMPDU, then any supported rates transmitted in that frame that include rates that are common to both PBCC and CCK shall be interpreted by receiving and transmitting STA to indicate support for both PBCC and CCK at the indicated rate. However, if any of those rates are indicated as basic, then the basic rate designation shall be interpreted by receiving and transmitting STA to apply only for the CCK modulation and rate. That is, if the rate is indicated as basic, the basic designation does not apply to DSSS-OFDM, PBCC, or ERP-PBCC.

Insert the following subclauses (7.3.2.13 and 7.3.2.14) at the end of 7.3.2:

7.3.2.13 ERP Information element

The ERP Information element contains information on the presence of Clause 15 or Clause 18 stations in the BSS that are not capable of Clause 19 (ERP-OFDM) data rates. It also contains the requirement of the ERP Information element sender (AP in a BSS or STA in an IBSS) as to the use of protection mechanisms to optimize BSS performance and as to the use of long or short Barker preambles. See Figure 42E for a definition of the frame element.

If one or more NonERP STAs are associated in the BSS, the Use_Protection bit shall be set to 1 in transmitted ERP Information Elements.

In an IBSS, the setting of the Use_Protection bit is left to the STA. In an IBSS, there is no uniform concept of association; therefore, a typical algorithm for setting the Use_Protection bit will take into account the traffic pattern and history on the network. If a member of an IBSS detects one or more NonERP STAs that are members of the same IBSS, then the Use_Protection bit should be set to 1 in the ERP Information Element of transmitted Beacon and Probe Response frames.

The NonERP_Present bit shall be set to 1 when a NonERP STA is associated with the BSS. Examples of when the NonERP present bit may additionally be set to 1 include, but are not limited to, when

a) A NonERP infrastructure or independent BSS is overlapping (a NonERP BSS may be detected by the reception of a Beacon where the supported rates contain only Clause 15 or Clause 18 rates).
b) In an IBSS, if a Beacon frame is received from one of the IBSS participants where the supported rate set contains only Clause 15 or Clause 18 rates.
c) A management frame (excluding a Probe Request) is received where the supported rate set includes only Clause 15 or Clause 18 rates.

ERP APs and ERP STAs shall invoke the use of a protection mechanism after transmission or reception of the Use_Protection bit with a value of 1 in an MMPDU to or from the BSS that the ERP AP or ERP STA has joined or started. ERP APs and ERP STAs may additionally invoke protection mechanism use at other times. ERP APs and ERP STAs may disable protection mechanism use after transmission or reception of the Use_Protection bit with a value of 0 in an MMPDU to or from the BSS that the ERP AP or ERP STA has joined or started.

When there are no NonERP STAs associated with the BSS and the ERP Information Element sender's dot11ShortPreambleOptionImplemented MIB variable is set to true, then the Barker_Preamble_Mode bit may be set to 0. The Barker_Preamble_Mode bit shall be set to 1 by the ERP Information Element sender if

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one or more associated NonERP STAs are not short preamble capable as indicated in their Capability Information field, or if the ERP Information Element senders dot11ShortPreambleOptionImplemented MIB variable is set to false.

If a member of an IBSS detects one or more non-short preamble-capable STAs that are members of the same IBSS, then the Barker_Preamble_Mode bit should be set to 1 in the transmitted ERP Information Element.

ERP APs and ERP STAs shall use long preambles when transmitting Clause 15, Clause 18, and Clause 19 frames after transmission or reception of an ERP Information Element with a Barker_Preamble_Mode value of 1 in an MMPDU to or from the BSS that the ERP AP or ERP STA has joined or started, regardless of the value of the short preamble capability bit from the same received or transmitted MMPDU that contained the ERP Information Element. ERP APs and ERP STAs may additionally use long preambles when transmitting Clause 15, Clause 18, and Clause 19 frames at other times. ERP APs and ERP STAs may use short preambles when transmitting Clause 15, Clause 18, and Clause 19 frames after transmission or reception of an ERP Information Element with a Barker_Preamble_Mode value of 0 in an MMPDU to or from the BSS that the ERP AP or ERP STA has joined or started, regardless of the value of the short preamble capability bit from the same received or transmitted MMPDU. NonERP STAs and NonERP APs may also follow the rules given in this paragraph.

Recommended behavior for setting the Use_Protection bit is contained in 9.10.

The ERP Information element shall have the form shown in Figure 42E.

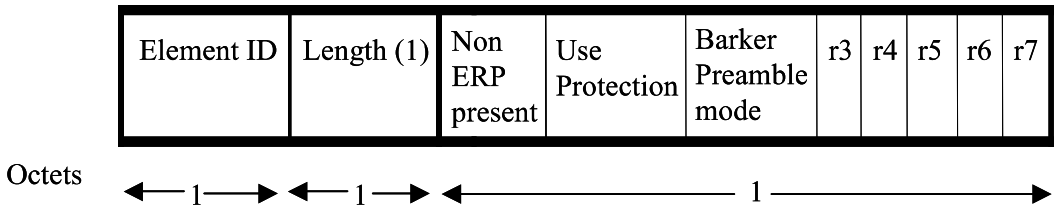


Figure 42E—ERP Information element

Bits r3 through r7 are reserved, set to 0, and are ignored on reception. Note that the length of this element is flexible and may be expanded in the future.

7.3.2.14 Extended Supported Rates element

The Extended Supported Rates element specifies the rates in the OperationalRateSet as described in the MLME_JOIN.request and MLME_START.request primitives that are not carried in the Supported Rates element. The information field is encoded as 1 to 255 octets where each octet describes a single supported rate.

Within Beacon, Probe Response, Association Response, and Reassociation Response management frames, each supported rate belonging to the BSS basic rate set, as defined in 10.3.10.1, is encoded as an octet with the msb (bit 7) set to 1 and bits 6 through 0 are set to the appropriate value from the valid range column of the DATA_RATE row of the table in 10.4.4.2 (e.g., a 1 Mbit/s rate belonging to the BSS basic rate set is encoded as X'82'). Rates not belonging to the BSS basic rate set are encoded with the msb set to 0, and bits 6 through 0 are set to the appropriate value from the valid range column of the DATA_RATE row of the table in 10.4.4.2 (e.g., a 2 Mbit/s rate not belonging to the BSS basic rate set is encoded as X'04'). The msb of each octet in the Extended Supported Rate element in other management frame types is ignored by receiving STAs.

BSS basic rate set information in Beacon and Probe Response management frames is used by STAs in order to avoid associating with a BSS if they do not support all the data rates in the BSS basic rate set.

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For stations supporting eight or fewer data rates, this element is optional for inclusion in all of the frame types that include the supported rates element. For stations supporting more than eight data rates, this element shall be included in all of the frame types that include the supported rates element.

The Extended Supported Rates element has the format shown in Figure 42F.

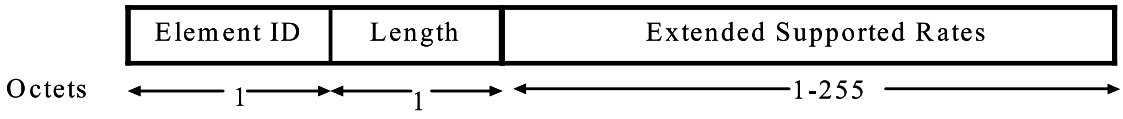


Figure 42F—Extended Supported Rates element format

9. MAC sublayer functional description

9.2 DCF

Change the eleventh paragraph in 9.2 as shown:

The medium access protocol allows for stations to support different sets of data rates. All STAs shall be able to receive and transmit at all the data rates in the aBasicRateSet specified parameter of the MLME_Join.request and MLME_Start.request primitives. To support the proper operation of the RTS/CTS and the virtual CS mechanism, all STAs shall be able to detect the RTS and CTS frames. ~~For this reason, the RTS and CTS frames shall be transmitted at one of the rates in the BSS basic rate set. (See 9.6 for a description of multirate operation.)~~

Insert the following subclauses after 9.2.10:

9.2.11 NAV distribution

When a node needs to distribute NAV information, for instance, to reserve the medium for a transmission of a non-basic rate frame (that may not be heard by other nodes in the BSS), the node may first transmit a CTS frame with the RA field equal to its own MAC address (CTS-to-self) and with a duration value that protects the pending transmission, plus possibly an ACK frame.

The CTS-to-self NAV distribution mechanism is lower in network overhead cost than is the RTS/CTS NAV distribution mechanism, but CTS-to-self is less robust against hidden nodes and collisions than RTS/CTS. STAs employing a NAV distribution mechanism should choose a mechanism such as CTS-to-self or RTS/CTS that is appropriate for the given network conditions. If errors occur when employing the CTS-to-self mechanism, STAs should switch to a more robust mechanism.

9.2.12 Determination of PLME aCWmin characteristics

In the case of the Clause 19 Extended Rate PHY, the aCWmin value is dependent on the requestor's characteristic rate set. The characteristic rate set is equal to the IBSS's supported rate set when the STA is operating as a member of an IBSS. It is equal to the AP's supported rate set when the STA is associated with an AP. At all other times, it is equal to the STA's mandatory rate set. The MAC variable aCWmin is set to aCWmin(0) if the characteristic rate set includes only rates in the set 1, 2, 5.5, 11 otherwise, aCWmin is set to aCWmin(1). If the returned value for aCWmin is a scalar, then the MAC always sets the variable aCWmin to the returned scalar value of aCWmin.

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9.6 Multirate support

Change the text of 9.6 as shown:

Some PHYs have multiple data transfer rate capabilities that allow implementations to perform dynamic rate switching with the objective of improving performance. The algorithm for performing rate switching is beyond the scope of this standard, but in order to ensure coexistence and interoperability on multirate-capable PHYs, this standard defines a set of rules ~~that shall~~ to be followed by all STAs.

~~All control frames shall be transmitted at one of the rates in the BSS basic rate set so that they will be understood.~~

All control frames that initiate a frame exchange shall be transmitted at one of the rates in the BSSBasicRateSet, unless the transmitting STAs protection mechanism is enabled, and the control frame is a protection mechanism frame; in which case, the control frame shall be transmitted at a rate according to the separate rules for determining the rates of transmission of protection frames in 9.10.

All frames with multicast or broadcast ~~receiver~~ in the addresses1 field shall be transmitted at one of the rates included in the BSS basic rate set, regardless of their type or subtype.

Data and/or management MPDUs with ~~a~~ unicast ~~receiver~~ in addresses1 shall be sent on any supported data rate selected by a rate switching mechanism ~~(whose output is an internal MAC variable called MAC-CurrentRate, which is used for calculating the Duration/ID field of each frame). An~~ No STA shall ~~not~~ transmit a unicast frame at a rate that is ~~known~~ not ~~to be~~ supported by the destination STA, as reported in any Supported Rates and Extended Supported Rates element in the management frames. For frames of type Data + CF – ACK, Data + CF – Poll + CF – ACK, and CF – Poll + CF – ACK, the rate chosen to transmit the frame should be supported by both the addressed recipient STA and the STA to which the ACK is intended.

Under no circumstances shall a STA initiate transmission of a data or management frame at a data rate higher than the greatest rate in the OperationalRateSet, a parameter of the MLME_JOIN.request primitive.

To allow the transmitting STA to calculate the contents of the Duration/ID field, ~~the responding~~ a STA responding to a received frame shall transmit its Control Response ~~and Management Response frames~~ (either CTS or ACK) frames at the highest rate in the BSSBasicRateSet that is less than or equal to the rate of the immediately previous frame in the frame exchange sequence (as defined in 9.7) and that is of the same modulation type as the received frame. If no rate in the basic rate set meets these conditions, then the control frame sent in response to a received frame shall be transmitted at the highest mandatory rate of the PHY that is less than or equal to the rate of the received frame, and that is of the same modulation type as the received frame. In addition, the Control Response frame shall be sent using the same PHY options as the received frame, unless they conflict with the requirement to use the BSSBasicRateSet.

An alternative rate for the control response frame may be used, provided that the duration of the control response frame at the alternative rate is the same as the duration of the control response frame at the originally chosen rate and the alternative rate is in either the BSSBasicRateSet or the mandatory rate set of the PHY and the modulation of the control response frame at the alternative rate is the same type as that of the received frame.

~~For the HR/DSSS PHY, the time required to transmit a frame for use in the Duration/ID field is determined using the PLME-TXTIME.request primitive and the PLME-TXTIME.confirm primitive (see 10.4.7).~~

For the ~~5 GHz PHY~~ Clause 17, Clause 18, and Clause 19 PHYs, the time required to transmit a frame for use in the Duration/ID field is determined using the PLME-TXTIME.request primitive (see 10.4.6) and the PLME-TXTIME.confirm primitive (see 10.4.7) ~~The calculation method of TXTIME duration is defined in 17.4.3~~, both defined in 17.4.3, 18.3.4, 19.8.3.1, 19.8.3.2, or 19.8.3.3 depending on the PHY options.

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9.7 Frame exchange sequences

Change rows 1 and 2 and insert a new row following row 2 in Table 21 as shown:

Table 21—Frame sequences

Sequence	Frames in sequence	Usage
{CTS-} Data(bc/mc)	1 or 2	Broadcast or multicast MSDU
{CTS-} Mgmt(bc)	1 or 2	Broadcast MMPDU
CTS - [Frag - ACK -] Last - ACK	3 or more	Protected directed MSDU or MMPDU

Insert the following subclause at the end of Clause 9:

9.10 Protection mechanism

The intent of a protection mechanism is to ensure that a STA does not transmit an MPDU of type Data or an MMPDU with an ERP-OFDM preamble and header unless it has attempted to update the NAV of receiving NonERP STAs. The updated NAV period shall be longer than or equal to the total time required to send the data and any required response frames. ERP STAs shall use protection mechanisms (such as RTS/CTS or CTS-to-self) for ERP-OFDM MPDUs of type Data or an MMPDU when the Use_Protection field of the ERP Information element is set to 1 (see the requirements of 9.2.6). Protection mechanisms frames shall be sent using one of the mandatory Clause 15 or Clause 18 rates and using one of the mandatory Clause 15 or Clause 18 waveforms, so all STAs in the BSA will know the duration of the exchange even if they cannot detect the ERP-OFDM signals using their CCA function.

Note that when using the Clause 19 options, ERP-PBCC or DSSS-OFDM, there is no need to use protection mechanisms, as these frames start with a DSSS header.

In the case of a BSS composed of only ERP STAs, but with knowledge of a neighboring co-channel BSS having NonERP traffic, the AP may require protection mechanisms to protect the BSS's traffic from interference. This will provide propagation of NAV to all attached STAs and all STAs in a neighboring co-channel BSS within range by BSS basic rate set modulated messages. The frames that propagate the NAV throughout the BSS include RTS/CTS/ACK frames, all data frames with the "more fragments" field set to 1, all data frames sent in response to PS-Poll that are not proceeded in the frame sequence by a data frame with the "more fragments" field set to 1, Beacon frames with nonzero CF time, and CF-End frames.

When RTS/CTS is used as the protection mechanism, cases exist such as NAV resetting (discretionary, as indicated in 9.2.5.4), where a hidden station may reset its NAV and this may cause a collision. The likelihood of occurrence is low, and it is not considered to represent a significant impairment to overall system operation. A mechanism to address this possible situation would be to use alternative protection mechanisms, or to revert to alternative modulation methods.

If a protection mechanism is being used, a fragment sequence may only employ ERP-OFDM modulation for the final fragment and control response.

The rules for calculating RTS/CTS NAV fields are unchanged when using RTS/CTS as a protection mechanism.

Additionally, if any of the rates in the BSSBasicRateSet of the protection mechanism frame transmitting STA's BSS are Clause 15 or Clause 18 rates, then the protection mechanism frames shall be sent at one of those Clause 15 or Clause 18 basic rates.

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10. Layer management

10.4 PLME SAP interface

10.4.4 PLME-DSSSTESTMODE

10.4.4.2 PLME-DSSSTESTMODE.request

Change the sixth and eighth row in the table in 10.4.4.2 as shown:

Name	Type	Valid range	Description
DATA_RATE	Integer	2, 4, 11, 12, 18, 22, 24, 36, 44, 48, 66, 72, 96, 108	Selects among rates 02 = 1 Mbit/s 04 = 2 Mbit/s 11 = 5.5 Mbit/s 12 = 6 Mbit/s 18 = 9 Mbit/s 22 = 11 Mbit/s 24 = 12 Mbit/s 36 = 18 Mbit/s 44 = 22 Mbit/s 48 = 24 Mbit/s 66 = 33 Mbit/s 72 = 36 Mbit/s 96 = 48 Mbit/s 108 = 54 Mbit/s
MODULATION_CODE_TYPE	Integer ~~Boolean~~	null, 0, 1, 2	Selects the among modulation ~~code~~ options 0 = ~~CCK~~ no optional modulation modes 1 = ~~PBCC~~ optional ERP-PBCC modes 2 = optional DSSS-OFDM modes Can be null.

18. High Rate direct sequence spread spectrum (HR/DSSS) PHY specification

18.2 High Rate PLCP sublayer

18.2.2 PPDU format

Change the title and first paragraph of 18.2.2.2 as shown:

18.2.2.2 Short PPDU format ~~(optional)~~

The short PLCP preamble and header (HR/DSSS/short) is defined as optional for HR/DSSS. The Short Preamble and header may be used to minimize overhead and, thus, maximize the network data throughput. The format of the PPDU, with HR/DSSS/short, is depicted in Figure 132. For Clause 19 STAs, support of this preamble type is mandatory.

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Insert new Clause 19 as follows:

19. Extended Rate PHY specification

19.1 Overview

This clause specifies further rate extension of the PHY for the Direct Sequence Spread Spectrum (DSSS) system of Clause 15 and the extensions of Clause 18. Hereinafter the PHY defined in this clause will be known as the Extended Rate PHY (ERP). This PHY operates in the 2.4 GHz ISM band.

19.1.1 Introduction

The ERP builds on the payload data rates of 1 and 2 Mbit/s, as described in Clause 15, that use DSSS modulation and builds on the payload data rates of 1, 2, 5.5, and 11 Mbit/s, as described in Clause 18, that use DSSS, CCK, and optional PBCC modulations. The ERP draws from Clause 17 to provide additional payload data rates of 6, 9, 12, 18, 24, 36, 48, and 54 Mbit/s. Of these rates, transmission and reception capability for 1, 2, 5.5, 11, 6, 12, and 24 Mbit/s data rates is mandatory.

Two additional optional ERP-PBCC modulation modes with payload data rates of 22 and 33 Mbit/s are defined. An ERP-PBCC station may implement 22 Mbit/s alone or 22 and 33 Mbit/s. An optional modulation mode known as DSSS-OFDM is also incorporated with payload data rates of 6, 9, 12, 18, 24, 36, 48, and 54 Mbit/s.

19.1.2 Operational modes

The radio portion of all Clause 19-compliant ERP systems implements all mandatory modes of Clause 17 and Clause 18, except it uses the 2.4 GHz frequency band and channelization plan specified in 18.4.6. The ERP has the capability to decode all Clause 15 and Clause 18 PLCPs and all ERP-OFDM PLCPs. In addition, it is mandatory that all ERP-compliant equipment be capable of sending and receiving the short preamble that is (and remains) optional for Clause 18 PHYs.

The ERP has the capability to detect ERP and Clause 18 preambles whenever a clear channel assessment (CCA) is requested. Because protection mechanisms are not required in all cases, the ERP CCA mechanisms for all preamble types shall be active at all times.

An ERP BSS is capable of operating in any combination of available ERP modes (Clause 19 PHYs) and NonERP modes (Clause 15 or Clause 18 PHYs). For example, a BSS could operate in an ERP-OFDM-only mode, a mixed mode of ERP-OFDM and ERP-DSSS/CCK, or a mixed mode of ERP-DSSS/CCK and Non-ERP. When options are enabled, combinations are also allowed.

The changes to the base standard required to implement the ERP are summarized as follows:

a) ERP-DSSS/CCK
   1) The PHY uses the capabilities of Clause 18 with the following exceptions:
      i) Support of the short PLCP PPDU header format capability of 18.2.2.2 is mandatory.
      ii) CCA (see 18.4.8.4) has a mechanism that will detect all mandatory Clause 19 sync symbols.
      iii) The maximum input signal level (see 18.4.8.2) is –20 dBm.
      iv) Locking the transmit center frequency and the symbol clock frequency to the same reference oscillator is mandatory.

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b) ERP-OFDM
   1) The PHY uses the capabilities of Clause 17 with the following exceptions:
      i) The frequency plan is in accordance with 18.4.6.1 and 18.4.6.2 instead of 17.3.8.3.
      ii) CCA has a mechanism that will detect all mandatory Clause 19 sync symbols.
      iii) The frequency accuracy (see 17.3.9.4 and 17.3.9.5) is ±25 PPM.
      iv) The maximum input signal level (see 17.3.10.4) is -20 dBm.
      v) The slot time is 20 μs in accordance with 18.3.3, except that an optional 9 μs slot time may be used when the BSS consists of only ERP STAs.
      vi) SIFS time is 10 μs in accordance with 18.3.3. See 19.3.2.3 for more detail.
c) ERP-PBCC (Optional)
   1) This is a single-carrier modulation scheme that encodes the payload using a 256-state packet binary convolutional code. These are extensions to the PBCC modulation in Clause 18. ERP-PBCC modes with payload data rates of 22 and 33 Mbit/s are defined in 19.6.
d) DSSS-OFDM (Optional)
   1) This is a hybrid modulation combining a DSSS preamble and header with an OFDM payload transmission. DSSS-OFDM modes with payload data rates of 6, 9, 12, 18, 24, 36, 48, and 54 Mbit/s are defined in 19.7.
   2) If the optional DSSS-OFDM mode is used, the supported rates in that mode are the same as the ERP-OFDM supported rates.

The 2.4 GHz ISM band is a shared medium, and coexistence with other devices such as Clause 15 and Clause 18 STAs is an important issue for maintaining high performance in Clause 19 (ERP) STAs. The ERP modulations (ERP-OFDM, ERP-PBCC, and DSSS-OFDM) have been designed to coexist with existing Clause 15 and Clause 18 STAs. This coexistence is achieved by several means, including virtual carrier sense (RTS/CTS or CTS-to-self), carrier sense and collision avoidance protocols, and MSDU fragmentation.

19.1.3 Scope

This clause specifies the ERP entity and the deviations from earlier clauses to accommodate it. It is organized by reference to the relevant earlier clauses to avoid excessive duplication.

The Extended Rate PHY layer consists of the following two protocol functions:

a) A physical layer convergence function that adapts the capabilities of the physical medium dependent (PMD) system to the PHY service available. This function is supported by the PHY layer convergence procedure (PLCP), which defines a method for mapping the MAC sublayer protocol data units (MPDU) into a framing format suitable for sending and receiving user data and management information between two or more STAs using the associated PMD system. The PHY exchanges PHY protocol data units (PPDU) that contain PLCP service data units (PSDU). The MAC uses the PHY service, so each MPDU corresponds to a PSDU that is carried in a PPDU.
b) A PMD system, whose function defines the characteristics and method of transmitting and receiving data through a wireless medium between two or more STAs; each using the ERP.

19.1.4 Extended Rate PHY functions

The architecture of the ERP is depicted in the ISO/IEC basic reference model shown in Figure 141 of 18.4.1. The ERP contains three functional entities: the PMD function, the PHY convergence function (PLCP), and the layer management function.

The ERP service is provided to the MAC through the PHY service primitives described in Clause 12. Interoperability is addressed by use of the carrier sense mechanism specified in 9.2.1 and the protection mechanism in 9.10. This mechanism allows NonERP stations to know of ERP traffic that they cannot demodulate so that they may defer the medium to that traffic.

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19.2 PHY-specific service parameter list

The architecture of the IEEE 802.11 MAC is intended to be PHY independent. Some PHY implementations require PHY-dependent MAC state machines running in the MAC sublayer in order to meet certain PMD requirements. The PHY-dependent MAC state machine resides in a sublayer defined as the MAC sublayer management entity (MLME). In certain PMD implementations, the MLME may need to interact with the PLME as part of the normal PHY SAP primitives. These interactions are defined by the PLME parameter list currently defined in the PHY service primitives as TXVECTOR and RXVECTOR. The list of these parameters, and the values they may represent, are defined in the specific PHY specifications for each PMD. This subclause addresses the TXVECTOR and RXVECTOR for the ERP. The service parameters for RXVECTOR and TXVECTOR shall follow 17.2.2 and 17.2.3.

Several service primitives include a parameter vector. DATARATE and LENGTH are described in 12.3.4.4. The remaining parameters are considered to be management parameters and are specific to this PHY.

The parameters in Table 123A are defined as part of the TXVECTOR parameter list in the PHY-TXSTART.request service and PLME-TXTIME.request primitives.

Table 123A—TXVECTOR parameters

Parameter	Value
DATARATE	The rate used to transmit the PSDU in Mbit/s Allowed value depends on value of MODULATION parameter: ERP-DSSS: 1 and 2 ERP-CCK: 5.5 and 11 ERP-OFDM: 6, 9, 12, 18, 24, 36, 48, and 54 ERP-PBCC: 5.5, 11, 22, and 33 DSSS-OFDM: 6, 9, 12, 18, 24, 36, 48, and 54.
LENGTH	The length of the PSDU in octets Range: 1–4095.
PREAMBLE_TYPE	The preamble used for the transmission of the PPDU Enumerated type for which the allowed value depends on value of MODULATION parameter: ERP-OFDM: null ERP-DSSS, ERP-CCK, ERP-PBCC, DSSS-OFDM: SHORTPREAMBLE, LONGPREAMBLE.
MODULATION	The modulation used for the transmission of this PSDU Enumerated type: ERP-DSSS, ERP-CCK, ERP-OFDM, ERP-PBCC, DSSS-OFDM.
SERVICE	The scrambler initialization vector When the modulation format selected is ERP-OFDM or DSSS-OFDM, seven null bits are used for scrambler initialization as described in 17.3.5.1. The remaining bits are reserved. For all other ERP modulations that all start with ERP-DSSS short or long preamble, the bits of the SERVICE field are defined in Table 123C and the SERVICE field is not applicable in the TXVECTOR, so the entire field is reserved.
TXPWR_LEVEL	The transmit power level. The definition of these levels is up to the implementer. 1–8.

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The parameters in Table 123B are defined as part of the RXVECTOR parameter list in the PHY-RXSTART.indicate service primitive. When implementations require the use of these vectors, some or all of these parameters may be used in the vectors.

Table 123B—RXVECTOR parameters

Parameter	Value
DATARATE	The rate at which the PSDU was received in Mbit/s. Allowed value depends on value of MODULATION parameter: ERP-DSSS: 1 and 2 ERP-CCK: 5.5 and 11 ERP-OFDM: 6, 9, 12, 18, 24, 36, 48, and 54 ERP-PBCC: 5.5, 11, 22, and 33 DSSS-OFDM: 6, 9, 12, 18, 24, 36, 48, and 54.
LENGTH	The length of the PSDU in octets. Range: 1–4095.
PREAMBLE_TYPE	The preamble type detected during reception of the PPDU. Enumerated type for which the allowed value depends on value of MODULATION parameter: ERP-OFDM: null ERP-DSSS, ERP-CCK, ERP-PBCC, PBCC, DSSS-OFDM: SHORTPREAMBLE, LONGPREAMBLE.
MODULATION	The modulation used for the reception of this PSDU. Enumerated types: ERP-DSSS, ERP-CCK, ERP?OFDM, ERP-PBCC, DSSS-OFDM.
SERVICE	Null.
RSSI	The RSSI is a measure of the RF energy received by the ERP. The 8-bit value is in the range of 0 to RSSI maximum as described in 17.2.3.2.

19.3 Extended Rate PLCP sublayer

19.3.1 Introduction

This subclause provides a PHY layer convergence procedure (PLCP) for the ERP. The convergence procedure specifies how PSDUs are converted to and from PPDUs at the transmitter and receiver. The PPDU is formed during data transmission by appending the PSDU to the Extended Rate PLCP preamble and header. At the receiver, the PLCP preamble and header are processed to aid in the demodulation and delivery of the PSDU.

19.3.2 PPDU format

An ERP STA shall support three different preamble and header formats. The first is the Long Preamble and header described in 19.3.2.1 (and based on 18.2.2.1 with redefinition of reserved bits defined therein). This PPDU provides interoperability with Clause 18 STAs when using the 1, 2, 5.5, and 11 Mbit/s data rates; the optional DSSS-OFDM modulation at all OFDM rates; and the optional ERP-PBCC modulation at all ERP-PBCC rates. The second is the Short Preamble and header described in 19.3.2.2 (and based on 18.2.2.2 wherein it is optional). The short preamble supports the rates 2, 5.5, and 11 Mbit/s as well as DSSS-OFDM and ERP-PBCC. The third is the ERP-OFDM preamble and header specified in 19.3.2.3 (and based on 17.3.2). The ERP has two optional PPDU formats, described in 19.3.2.4 and 19.3.2.5, to support the optional DSSS-OFDM modulation rates.

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19.3.2.1 Long preamble PPDU format

Figure 131 of 18.2.2.1 shows the basic format for the long preamble PPDU. This preamble is appropriate for use with the 1, 2, 5.5, and 11 Mbit/s (Clause 18) modes and is compatible with BSSs using these modes. To support the optional modes included in the ERP, the Long Preamble PPDU only differs from 18.2.2.1 in the following:

a) The use of one bit in the SERVICE field to indicate when the optional ERP-PBCC mode is being used.
b) The use of two additional bits in the SERVICE field to resolve the length ambiguity when the optional ERP-PBCC-22 and ERP-PBCC-33 modes are being used.
c) Three additional optional rates given by the following SIGNAL field octets where the lsb is transmitted first in time:
    1) X'DC' (msb to lsb) for 22 Mbit/s ERP-PBCC
    2) X'21' (msb to lsb) for 33 Mbit/s ERP-PBCC
    3) X'1E' (msb to lsb) for all DSSS-OFDM rates

Three bits of the SERVICE field have been defined to support the optional modes of the ERP standard. Table 123C shows graphically the assignment of the bits within the SERVICE field. The bits b0, b1, and b4 are reserved and shall be set to 0. Bit b2 is used to indicate that the transmit frequency and symbol clocks are derived from the same oscillator. For all ERP systems, the Locked Clock Bit shall be set to 1. Bit b3 is used to indicate if the data are modulated using the optional ERP-PBCC modulation. Bit b3 is defined in 18.2.3.4 with the caveat that the ERP-PBCC mode now has the additional optional rates of 22 and 33 Mbit/s as defined in 19.3.3.2. Bits b5, b6, and b7 are used to resolve data field length ambiguities for the optional ERP-PBCC-11 through ERP-PBCC-33 modes. These bits are fully defined in 19.6. Bit b7 is also used to resolve data field length ambiguities for the CCK 11 Mbit/s mode and is defined in 18.2.3.5. Bits b3, b5, and b6 are set to 0 for CCK.

Table 123C—SERVICE field bit definitions

b0	b1	b2	b3	b4	b5	b6	b7
Reserved	Reserved	Locked Clock Bit 0 = not locked 1 = locked	Modulation Selection 0 = Not ERP-PBCC 1 = ERP-PBCC	Reserved	Length Extension Bit (ERP-PBCC)	Length Extension Bit (ERP-PBCC)	Length Extension Bit

19.3.2.1.1 ERP PLCP length field calculation

For the long and short preamble modes other than PBCC, the length field shall be calculated as in 18.2.3.5.

19.3.2.1.2 ERP-PBCC PLCP length (LENGTH) field calculation

For the ERP-PBCC PLCP length field, the transmitted value shall be determined from the LENGTH and DataRate parameters in the TXVECTOR issued with the PMD-TXSTART.request primitive described in 18.4.5.6.

The length field provided in the TXVECTOR is in octets and is converted to microseconds for inclusion in the PLCP LENGTH field. The Length Extension bits are provided to resolve the ambiguity in the number of octets that is described by an integer number of microseconds for any data rate over 8 Mb/s. These bits are used to indicate which of the smaller potential number of octets is correct.

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— 11 Mbit/s PBCC see 18.2.3.5.

— 22 Mbit/s ERP-PBCC Length = (number of octets + 1)*4/11, rounded up to the next integer; the SERVICE field b6 and b7 bits shall each indicate a 0 if the rounding took less than 4/11ths; the SERVICE field bit b6 shall indicate a 0 and the SERVICE field bit b7 shall indicate a 1 if the rounding took 4/11ths or more and less than 8/11ths; and the SERVICE field bit b6 shall indicate a 1 and the SERVICE field bit b7 shall indicate a 0 if the rounding took 8/11ths or more.

— 33 Mbit/s ERP-PBCC Length = (number of octets + 1)*8/33, rounded up to the next integer; the SERVICE field b5, b6, and b7 bits shall each indicate a 0 if the rounding took less than 8/33; the SERVICE field bit b5 shall indicate a 0, b6 shall indicate a 0, and the SERVICE field bit b7 shall indicate a 1 if the rounding took more than or equal to 8/33 and less than 16/33; the SERVICE field bit b5 shall indicate 0, b6 shall indicate a 1, and b7 shall indicate a 0 if the rounding took more than or equal to 16/33 and less than 24/33; the SERVICE field bit b5 shall indicate 0, b6 shall indicate a 1, and b7 shall indicate a 1 if the rounding took more than or equal to 24/33 and less than 32/33; the SERVICE field bit b5 shall indicate 1, b6 shall indicate a 0, and b7 shall indicate a 0 if the rounding took 32/33 or more.

At the receiver, the number of octets in the MPDU is calculated as follows:

— 22 Mbit/s ERP-PBCC Number of octets = (Length * 11/4) – 1, rounded down to the next integer, minus 1 if the SERVICE field bit b6 is a 0 and the SERVICE field bit b7 is a 1, or minus 2 if the SERVICE field bit b6 is a 1 and the SERVICE field bit b7 is a 0.

— 33 Mbit/s ERP-PBCC Number of octets = (Length * 33/8) – 1, rounded down to the next integer, minus 1 if the SERVICE field bit b5 is a 0, b6 is a 0, and the SERVICE field bit b7 is a 1, or minus 2 if the SERVICE field bit b5 is a 0, b6 is a 1, and the SERVICE field bit b7 is a 0, or minus 3 if the SERVICE field bit b5 is a 0, b6 is a 1, and the SERVICE field bit b7 is a 1, or minus 4 if the SERVICE field bit b5 is a 1, b6 is a 0, and the SERVICE field bit b7 is a 0.

Table 123D shows an example calculation for several packet lengths of ERP-PBCC at 22 Mbit/s.

Table 123D—Example of LENGTH calculations for ERP-PBCC-22

TX Octets	(Octets+1) * 4/11	LENGTH	Length Extension bit b6	Length Extension bit b7	LENGTH *11/4	floor(X)	RX Octets
1023	372.364	373	0	1	1025.75	1025	1023
1024	372.727	373	0	0	1025.75	1025	1024
1025	373.091	374	1	0	1028.50	1028	1025
1026	373.455	374	0	1	1028.50	1028	1026

19.3.2.2 Short preamble PPDU format

Figure 132 of 18.2.2.2 shows the basic format for the short preamble PPDU. For the ERP, support for this preamble is mandatory. The short preamble is appropriate for use with 2, 5.5, and 11 Mbit/s modes. The bits of the Short PLCP SERVICE field and RATE field are the same as for the Long PLCP SERVICE field and RATE field and are defined in 19.3.2.1.

19.3.2.3 ERP-OFDM PPDU format

The format, preamble, and headers for the ERP-OFDM PLCP PPDU are described in 17.3.2 through 17.3.5. For the ERP-OFDM modes, the DATA Field that contains the SERVICE field, the PSDU, the TAIL bits, and the PAD bits shall follow 17.3.5.

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For ERP-OFDM modes, an ERP packet is followed by a period of no transmission with a length of 6 µs called the signal extension. The purpose of this extension is to make the TXTIME calculation in 19.8.3 result in a transmission duration interval that includes an additional 6 µs. The SIFS time for Clause 17 packets is 16 µs, and the SIFS time for Clause 18 packets is 10 µs. The longer SIFS time in Clause 17 is to allow extra time for the convolutional decode process to finish. As Clause 19 packets will use a SIFS time of 10 µs, this extra 6 µs length extension is used to ensure that the Transmitter computes the Duration field in the MAC header incorporating the 6 µs of "idle time" following each ERP-OFDM transmission. This ensures that the NAV value of Clause 18 STAs is set correctly.

The "carrier-sense mechanism" described in 9.2.1 combines the NAV state and the STA's transmitter status with physical carrier sense to determine the busy/idle state of the medium. The time interval between frames is called the inter-frame spacing (IFS). A STA shall determine that the medium is idle through the use of the CCA mechanism for the interval specified. The starting reference of slot boundaries is the end of the last symbol of the previous frame on the medium. For ERP-OFDM frames, this includes the length extension. For ERP-OFDM frames, a STA shall generate the PHY RX_END indication, 6 µs after the end of the last symbol of the previous frame on the medium. This adjustment shall be performed by the STA based on local configuration information set using the PLME SAP.

19.3.2.4 DSSS-OFDM long preamble PPDU format

Both long and short preambles and headers as previously described in 19.3.2.1 and 19.3.2.2 are used with DSSS-OFDM.

For all DSSS-OFDM rates and preamble modes, the PLCP SIGNAL Field described in 18.2.3.3 shall be set to a 3 Mbit/s value. That is, the eight-bit value is set to X'1E' (msb to lsb). For DSSS-OFDM, this value is simply a default setting used for BSS compatibility and to ensure that NonERP stations read the length field and defer the medium for that time even though they cannot demodulate the MPDU due to unsupported rates.

Figure 153A shows the PPDU format for the long preamble case. As seen, the PSDU is appended to the PLCP Preamble and the PLCP header. The PLCP Preamble is the same as described in 18.2.3.1 and 18.2.3.2. The PLCP header is similar to the one described in 19.3.2.1. The PSDU has a format that is nearly identical to a Clause 17 PLCP. The differences are described in 19.3.3.4.

The scrambler of 18.2.4 is used to scramble the DSSS-OFDM PLCP header, and the scrambler in 17.3.5.4 is used to scramble the data symbols in the OFDM segment.

19.3.2.4.1 DSSS-OFDM PLCP length field calculation

For both the long and the short preamble PLCP cases, the length field calculation in terms of data packet length is as follows:

LENGTH = PSDUsyncOFDM + PSDUSignalOFDM + …
4 × Ceiling((PLCPServiceBits + 8 × (NumberOfOctets) + PadBits) / NDBPS) + SignalExtension

where

PSDUsyncOFDM is 8 µs (OFDM long training symbols),
PSDUSignalOFDM is 4 µs,
Ceiling is a function that returns the smallest integer value greater than or equal to its argument value,
PLCPServiceBits is 8 bits,
NumberOfOctets is the number of data octets in the PSDU,
PadBits is 6 bits,
N_{DBPS} is the number of data bits per OFDM symbol,
SignalExtension is 6 µs.

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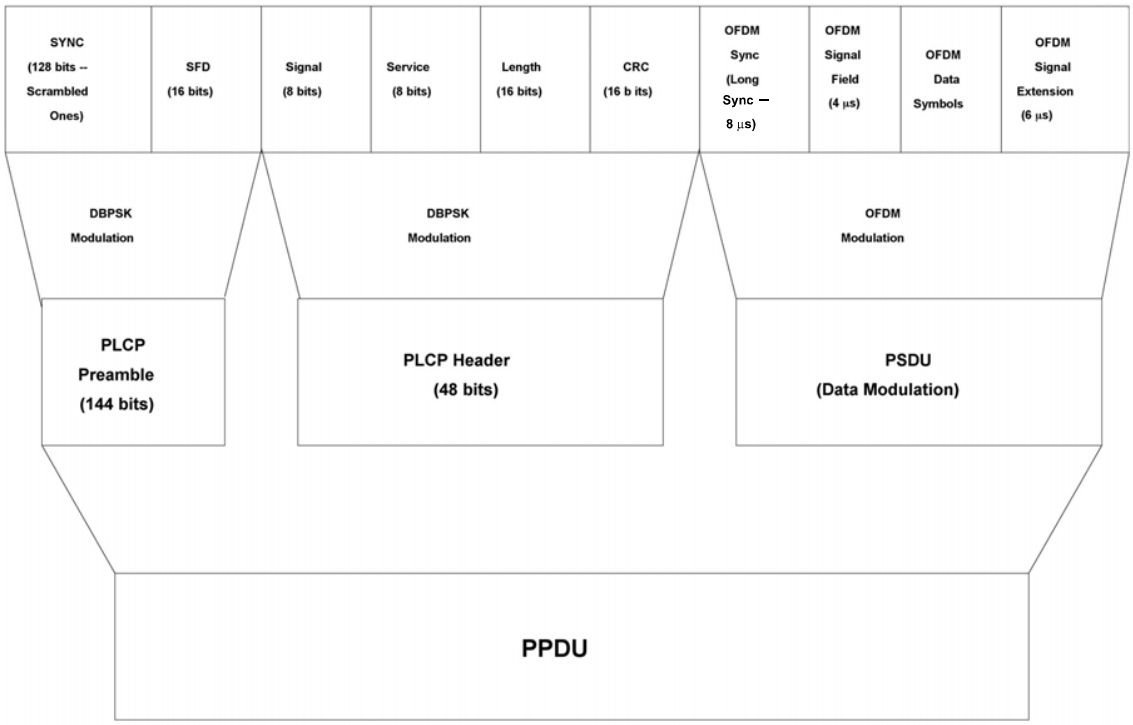


Figure 153A—Long preamble PPDU format for DSSS-OFDM

The length field is defined in units of microseconds and shall correspond to the calculated length of the PSDU. Note that the length extension bits in the Signal field are not needed or used for DSSS-OFDM.

19.3.2.5 Short DSSS-OFDM PLCP PPDU format

The short PLCP preamble and header are used to maximize the throughput by reducing the overhead associated with the preamble and header. Figure 153B shows the short preamble PLCP PPDU format. As seen, the PSDU is appended to the PLCP Preamble and the PLCP header. The short PLCP Preamble is described in 18.2.3.8 and 18.2.3.9. The PLCP header is as described in 19.3.2.4. The PSDU has a format that is nearly identical to Clause 17 PLCP. The differences are described in 19.3.3.4.

19.3.3 PLCP data modulation and rate change

19.3.3.1 Long and short preamble formats

The long and short PLCP preamble and the long PLCP header shall be transmitted using the 1 Mbit/s DBPSK modulation. The short PLCP header shall be transmitted using the 2 Mbit/s modulation. The SIGNAL and SERVICE fields combined shall indicate the modulation and rate that shall be used to transmit the PSDU. The transmitter and receiver shall initiate the modulation and rate indicated by the SIGNAL and SERVICE fields, starting with the first octet of the PSDU. The PSDU transmission rate shall be set by the DATARATE parameter in the TXVECTOR, issued with the PHY-TXSTART.request primitive described in 18.4.5.1.

Four modulation formats are mandatory, 1 and 2 Mbit/s ERP-DSSS and 5.5 and 11 Mbit/s ERP-CCK, and they are specified in 18.4.6.3.

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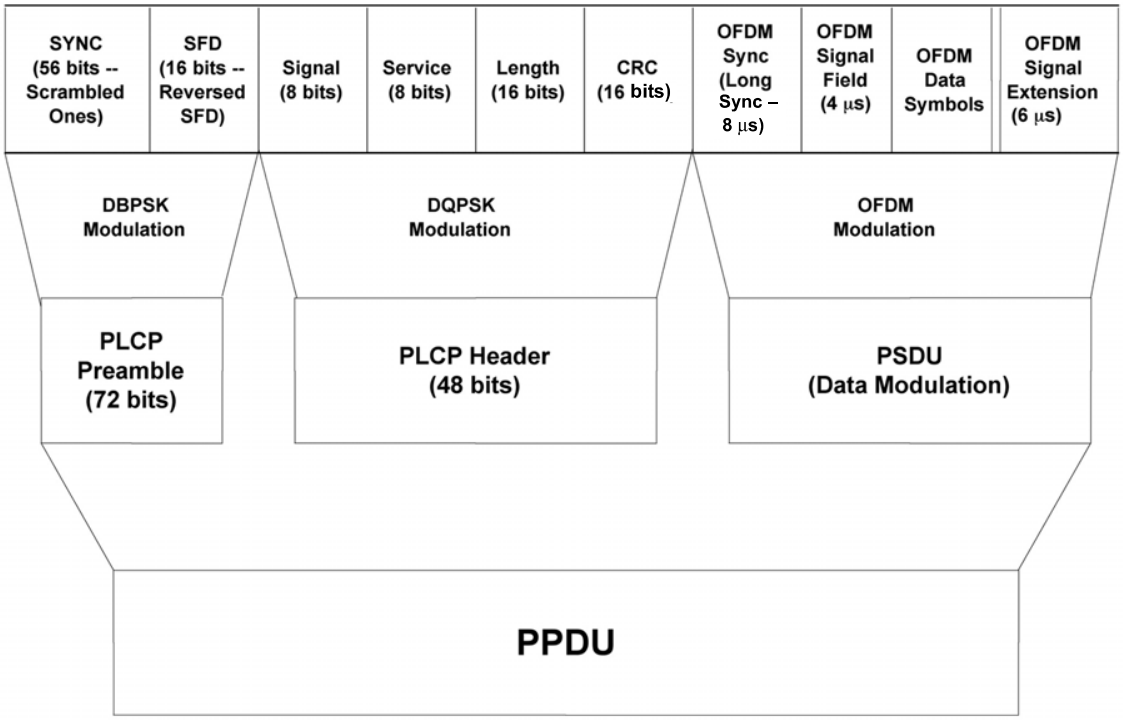


Figure 153B—Short preamble PPDU format for DSSS-OFDM

Four optional ERP-PBCC modulation formats and data rates are specified for the Enhanced Rate PHY (ERP). They shall be based on Packet Binary Convolutional Coding (PBCC) 5.5, 11, 22, and 33 Mbit/s modulations. The rates of 5.5 and 11 Mbit/s are described in 18.4.6.6. No change in the spectral mask of 18.4.7.3 is required for these modes.

19.3.3.2 ERP-PBCC 22 Mbit/s and 33 Mbit/s formats

In the PBCC encoder, incoming data are first encoded with a packet binary convolutional code. A cover code (as defined in PBCC modes in 18.4.6.6) is applied to the encoded data prior to transmission through the channel.

The packet binary convolutional code that is used is a 256-state, rate 2/3 code. The generator matrix for the code is given in Equation (37).

$$G = \begin{bmatrix} 1 + D^4 & D & D + D^3 \\ D^3 & 1 + D^2 + D^4 & D + D^3 \end{bmatrix} \tag{37}$$

In octal notation, the generator matrix is given in Equation (38).

$$G = \begin{bmatrix} 21 & 2 & 12 \\ 10 & 25 & 12 \end{bmatrix} \tag{38}$$

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As the system is frame (PPDU) based, the encoder shall be in state zero; i.e., all memory elements contain zero, at the beginning of every PPDU. The encoder shall also be placed in a known state at the end of every PPDU to prevent the data bits near the end of the PPDU from being decoded incorrectly. This is achieved by appending one octet containing all zeros to the end of the PPDU prior to transmission and discarding the final octet of each received PPDU.

An encoder block diagram is shown in Figure 153C. It consists of two paths of four memory elements each. For every pair of data bits input, three output bits are generated. The output of the convolutional code is mapped to an 8-PSK constellation; each 3-bit output sequence from the packet binary convolutional encoder is used to produce one symbol. This yields a throughput of two information bits per symbol. In ERP-PBCC-22 and ERP-PBCC-33, the input data stream is divided into pairs of adjacent bits. In each pair, the first bit is fed to the upper input of the convolutional encoder, and the second is fed to the lower input of the convolutional encoder. An illustration of the mapping for the jth (j≥0) pair of input bits (b2j, b2j+1) is given in Figure 153C.

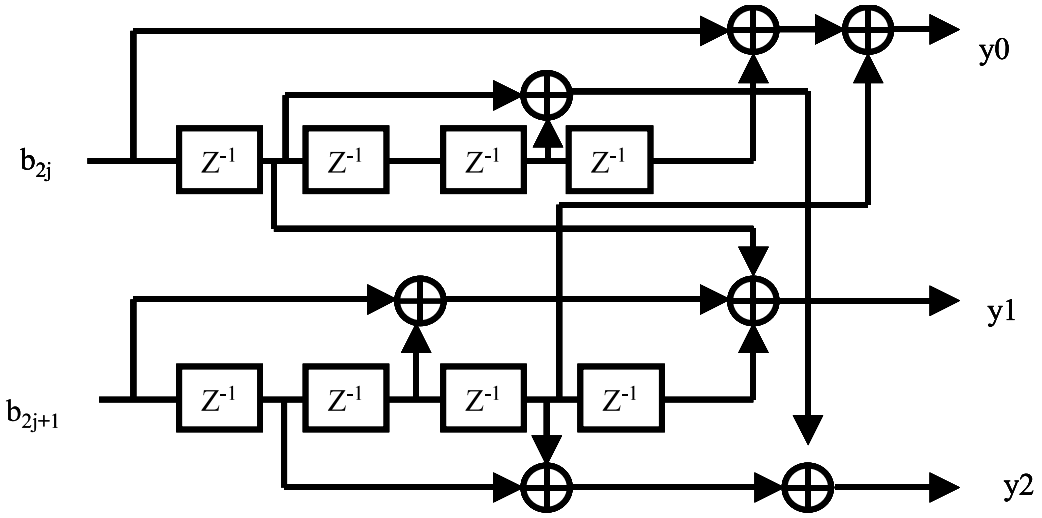


Figure 153C—22/33 Mbit/s ERP-PBCC convolutional encoder

The phase of the first complex chip of the 22 Mbit/s PSDU shall be defined with respect to the phase of the last chip of the PCLP header, i.e., the last chip of the CRC check. The phase of the first complex chip of the 33 Mb/s PSDU shall be defined with respect to the phase of the last chip of the clock switch section, i.e., the last chip of the ReSync field. The bits (y2 y1 y0) = (0,0,0) shall indicate the same phase as the last chip of the CRC check. The other seven combinations of (y2 y1 y0) shall be defined with respect to this reference phase as shown in Figure 153D.

The mapping from BCC outputs to 8-PSK constellation points is determined by a pseudo-random cover sequence. The cover sequence is the same one as described in 18.4.6.6. The current binary value of this sequence at every given point in time is taken as shown in Figure 153D. The mapping is shown in Figure 153D.

ERP-PBCC mode achieves a 33 Mbit/s data rate by using a 16.5 MHz clock for the data portion of the packet. The data portion is otherwise identical to the 22 Mbit/s ERP-PBCC modulations. The structure and clock speed of the preamble is the same as in Clause 18. An extra clock switch section between the preamble and the data portion is added, with the format described below. The same pulse shape shall be used in each clock domain.

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