IEEE P802.11
Wireless LANs

Annex E proposed text

Date: April 25, 1999

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Abstract

This document serves as a proposed text to be inserted as Annex E in the 802.11a standard. The purpose of this annex is to bring an example of encoding a frame for the OFDM PHY. The example goes through the all the encoding details defined by the standard.

Annex E

The purpose of this annex is to bring an example of encoding a frame for the OFDM PHY described in Clause 17 of the 802.11 standard. The encoding illustration goes through the following stages:

a) Generating the short training sequences section of the preamble.
b) Generating the long preamble sequence section of the preamble.
c) Generating the SIGNAL field bits.
d) Coding and interleaving the SIGNAL field bits.
e) Mapping the SIGNAL field into frequency domain.
f) Pilot insertion.
g) Transforming into time domain.
h) Delineation of the data octet stream into a bit stream.
i) Prepending the SERVICE field and adding the pad bits, forming thus the DATA.
j) Scrambling and zeroing the tail bits.
k) Encoding the DATA with a convolutional encoder and puncturing.
l) Mapping into complex QAM16 symbols.
m) Pilots Insertion.
n) Transforming from frequency to time and adding a circular prefix.
o) Concatenating the OFDM symbols into a single time-domain signal.

In the description of time domain waveforms a complex baseband signal at 20 Msamples per second shall be used.

The example uses the 36 Mbit/s data rate and a message of 100 octets. These parameters are chosen in order to illustrate as many nontrivial aspects of the processing:

- Use of several bits per symbol (4 in our case)
- Puncturing of the convolutional code
- Interleaving which uses non-trivially the LSB-MSB swapping stage
- Scrambling of the pilot subcarriers

1. The message

The message being encoded is the first 72 characters of the well-known "Ode to Joy" by F. Schiller:

Joy, bright spark of divinity,
Daughter of Elysium,
Fire-insired we tread
Thy sanctuary.
Thy magic power re-unites
All that custom has divided,
All men become brothers
Under the sway of thy gentle wings…

The message is converted to ASCII, prepended with an appropriate MAC header and a CRC32 is added. The resulting 100 octets PSDU is shown in table 1.

#	Val	Val	Val	Val	Val
1… 5	04	02	00	2e	00
6… 10	60	08	cd	37	a6
11…15	00	20	d6	01	3c
16…20	f1	00	60	08	ad
21…25	3b	af	00	00	4a
26…30	6f	79	2c	20	62
31…35	72	69	67	68	74
36…45	20	73	70	61	72
41…45	6b	20	6f	66	20
46…50	64	69	76	69	6e
51…55	69	74	79	2c	0a
56…60	44	61	75	67	68
61…55	74	65	72	20	6f
66…60	66	20	45	6c	79
71…55	73	69	75	6d	2c
76…60	0a	46	69	72	65
81…55	2d	69	6e	73	69
86…60	72	65	64	20	77
91…55	65	20	74	72	65
96…100	61	da	57	99	ed

Table 1: The message.

2. Generation of the preamble

2.1. Generation of the short sequences

The short sequences section of the preamble is described by its frequency domain representation, given in table 2.

###	Re	Im	###	Re	Im	###	Re	Im	###	Re	Im
-32	0	0	-16	-1.414	-1.414	0	0	0	16	1.414	1.414
-31	0	0	-15	0	0	1	0	0	17	0	0
-30	0	0	-14	0	0	2	0	0	18	0	0
-29	0	0	-13	0	0	3	0	0	19	0	0
-28	0	0	-12	-1.414	-1.414	4	1.414	1.414	20	-1.414	1.414
-27	0	0	-11	0	0	5	0	0	21	0	0
-26	0	0	-10	0	0	6	0	0	22	0	0
-25	0	0	-9	0	0	7	0	0	23	0	0
-24	1.414	1.414	-8	1.414	-1.414	8	1.414	1.414	24	1.414	1.414
-23	0	0	-7	0	0	9	0	0	25	0	0
-22	0	0	-6	0	0	10	0	0	26	0	0
-21	0	0	-5	0	0	11	0	0	27	0	0
-20	1.414	1.414	-4	-1.414	-1.414	12	-1.414	-1.414	28	0	0
-19	0	0	-3	0	0	13	0	0	29	0	0
-18	0	0	-2	0	0	14	0	0	20	0	0
-17	0	0	-1	0	0	15	0	0	31	0	0

Table 2: Frequency domain representation of the short sequences

One period of the IFFT on the contents of Table 2 is given in Table 3.

###	Re	Im	###	Re	Im	###	Re	Im	###	Re	Im
0	0.044	0.044	16	0.044	0.044	32	0.044	0.044	48	0.044	0.044
1	-0.109	-0.045	17	-0.109	-0.045	33	-0.109	-0.045	49	-0.109	-0.045
2	-0.044	0.062	18	-0.044	0.062	34	-0.044	0.062	50	-0.044	0.062
3	0.013	0.126	19	0.013	0.126	35	0.013	0.126	51	0.013	0.126
4	-0.133	-0.044	20	-0.133	-0.044	36	-0.133	-0.044	52	-0.133	-0.044
5	-0.095	0.052	21	-0.095	0.052	37	-0.095	0.052	53	-0.095	0.052
6	-0.018	0.062	22	-0.018	0.062	38	-0.018	0.062	54	-0.018	0.062
7	0.075	-0.066	23	0.075	-0.066	39	0.075	-0.066	55	0.075	-0.066
8	0.133	0.044	24	0.133	0.044	40	0.133	0.044	56	0.133	0.044
9	-0.042	0.071	25	-0.042	0.071	41	-0.042	0.071	57	-0.042	0.071
10	-0.044	-0.062	26	-0.044	-0.062	42	-0.044	-0.062	58	-0.044	-0.062
11	0.013	-0.152	27	0.013	-0.152	43	0.013	-0.152	59	0.013	-0.152
12	-0.044	-0.044	28	-0.044	-0.044	44	-0.044	-0.044	60	-0.044	-0.044
13	0.069	0.099	29	0.069	0.099	45	0.069	0.099	61	0.069	0.099
14	0.107	-0.062	30	0.107	-0.062	46	0.107	-0.062	62	0.107	-0.062
15	0.075	-0.085	31	0.075	-0.085	47	0.075	-0.085	63	0.075	-0.085

Table 3: One period of IFFT of the short sequences

###	Re	Im
0	0.022	0.022
1	-0.109	-0.045
2	-0.044	0.062
3	0.013	0.126
4	-0.133	-0.044
5	-0.095	0.052
6	-0.018	0.062
7	0.075	-0.066
8	0.133	0.044
9	-0.042	0.071
10	-0.044	-0.062
11	0.013	-0.152
12	-0.044	-0.044
13	0.069	0.099
14	0.107	-0.062
15	0.075	-0.085
16	0.044	0.044
17	-0.109	-0.045
18	-0.044	0.062
19	0.013	0.126
20	-0.133	-0.044
21	-0.095	0.052
22	-0.018	0.062
23	0.075	-0.066
24	0.133	0.044
25	-0.042	0.071
26	-0.044	-0.062
27	0.013	-0.152
28	-0.044	-0.044
29	0.069	0.099
30	0.107	-0.062
31	0.075	-0.085
32	0.044	0.044
33	-0.109	-0.045
34	-0.044	0.062
35	0.013	0.126
36	-0.133	-0.044
37	-0.095	0.052
38	-0.018	0.062
39	0.075	-0.066
40	0.133	0.044
41	-0.042	0.071
42	-0.044	-0.062
43	0.013	-0.152
44	-0.044	-0.044
45	0.069	0.099
46	0.107	-0.062
47	0.075	-0.085
48	0.044	0.044
49	-0.109	-0.045
50	-0.044	0.062
51	0.013	0.126
52	-0.133	-0.044
53	-0.095	0.052
54	-0.018	0.062
55	0.075	-0.066
56	0.133	0.044
57	-0.042	0.071
58	-0.044	-0.062
59	0.013	-0.152
60	-0.044	-0.044
61	0.069	0.099
62	0.107	-0.062
63	0.075	-0.085
64	0.044	0.044
65	-0.109	-0.045
66	-0.044	0.062
67	0.013	0.126
68	-0.133	-0.044
69	-0.095	0.052
70	-0.018	0.062
71	0.075	-0.066
72	0.133	0.044
73	-0.042	0.071
74	-0.044	-0.062
75	0.013	-0.152
76	-0.044	-0.044
77	0.069	0.099
78	0.107	-0.062
79	0.075	-0.085
80	0.044	0.044
81	-0.109	-0.045
82	-0.044	0.062
83	0.013	0.126
84	-0.133	-0.044
85	-0.095	.
86	-0.018	0.062
87	0.075	-0.066
88	0.133	0.044
89	-0.042	0.071
90	-0.044	-0.062
91	0.013	-0.152
92	-0.044	-0.044
93	0.069	0.099
94	0.107	-0.062
95	0.075	-0.085
96	0.044	0.044
97	-0.109	-0.045
98	-0.044	0.062
99	0.013	0.126
100	-0.133	-0.044
101	-0.095	0.052
102	-0.018	0.062
103	0.075	-0.066
104	0.133	0.044
105	-0.042	0.071
106	-0.044	-0.062
107	0.013	-0.152
108	-0.044	-0.044
109	0.069	0.099
110	0.107	-0.062
111	0.075	-0.085
112	0.044	0.044
113	-0.109	-0.045
114	-0.044	0.062
115	0.013	0.126
116	-0.133	-0.044
117	-0.095	0.052
118	-0.018	0.062
119	0.075	-0.066
120	0.133	0.044
121	-0.042	0.071
122	-0.044	-0.062
123	0.013	-0.152
124	-0.044	-0.044
125	0.069	0.099
126	0.107	-0.062
127	0.075	-0.085
128	0.044	0.044
129	-0.109	-0.045
130	-0.044	0.062
131	0.013	0.126
132	-0.133	-0.044
133	-0.095	0.052
134	-0.018	0.062
135	0.075	-0.066
136	0.133	0.044
137	-0.042	0.071
138	-0.044	-0.062
139	0.013	-0.152
140	-0.044	-0.044
141	0.069	0.099
142	0.107	-0.062
143	0.075	-0.085
144	0.044	0.044
145	-0.109	-0.045
146	-0.044	0.062
147	0.013	0.126
148	-0.133	-0.044
149	-0.095	0.052
150	-0.018	0.062
151	0.075	-0.066
152	0.133	0.044
153	-0.042	0.071
154	-0.044	-0.062
155	0.013	-0.152
156	-0.044	-0.044
157	0.069	0.099
158	0.107	-0.062
159	0.075	-0.085
160	0.0221	0.0221

Table 4: Time domain representation of short sequences

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

Table 5: Frequency domain representation of the long sequences

The time domain representation is derived by performing IFFT on the contents of Table 5, cyclically extending the result to get the cyclic prefix and the multiplying with the window function of section 2.1 . The resulting 161 points vector is shown in Table 6. The samples are appended to the short sequence section by overlapping and adding element 160 of Table 4 to element 0 of Table 6.

###	Re	Im
0	-0.078	0.000
1	0.012	-0.098
2	0.092	-0.106
3	-0.092	-0.115
4	-0.003	-0.054
5	0.075	0.074
6	-0.127	0.021
7	-0.122	0.017
8	-0.035	0.151
9	-0.056	0.022
10	-0.060	-0.081
11	0.070	-0.014
12	0.082	-0.092
13	-0.131	-0.065
14	-0.057	-0.039
15	0.037	-0.098
16	0.062	0.062
17	0.119	0.004
18	-0.022	-0.161
19	0.059	0.015
20	0.024	0.059
21	-0.137	0.047
22	0.001	0.115
23	0.053	-0.004
24	0.098	0.026
25	-0.038	0.106
26	-0.115	0.055
27	0.060	0.088
28	0.021	-0.028
40	0.098	-0.026
41	0.053	0.004
42	0.001	-0.115
43	-0.137	-0.047
44	0.024	-0.059
45	0.059	-0.015
46	-0.022	0.161
47	0.119	-0.004
48	0.062	-0.062
49	0.037	0.098
50	-0.057	0.039
51	-0.131	0.065
52	0.082	0.092
53	0.070	0.014
54	-0.060	0.081
55	-0.056	-0.022
56	-0.035	-0.151
57	-0.122	-0.017
58	-0.127	-0.021
59	0.075	-0.074
60	-0.003	0.054
61	-0.092	0.115
62	0.092	0.106
63	0.012	0.098
64	-0.156	0.000
65	0.012	-0.098
66	0.092	-0.106
67	-0.092	-0.115
68	-0.003	-0.054
80	0.062	0.062
81	0.119	0.004
82	-0.022	-0.161
83	0.059	0.015
84	0.024	0.059
85	-0.137	0.047
86	0.001	0.115
87	0.053	-0.004
88	0.098	0.026
89	-0.038	0.106
90	-0.115	0.055
91	0.060	0.088
92	0.021	-0.028
93	0.097	-0.083
94	0.040	0.111
95	-0.005	0.120
96	0.156	0.000
97	-0.005	-0.120
98	0.040	-0.111
99	0.097	0.083
100	0.021	0.028
101	0.060	-0.088
102	-0.115	-0.055
103	-0.038	-0.106
104	0.098	-0.026
105	0.053	0.004
106	0.001	-0.115
107	-0.137	-0.047
108	0.024	-0.059
120	-0.035	-0.151
121	-0.122	-0.017
122	-0.127	-0.021
123	0.075	-0.074
124	-0.003	0.054
125	-0.092	0.115
126	0.092	0.106
127	0.012	0.098
128	-0.156	0.000
129	0.012	-0.098
130	0.092	-0.106
131	-0.092	-0.115
132	-0.003	-0.054
133	0.075	0.074
134	-0.127	0.021
135	-0.122	0.017
136	-0.035	0.151
137	-0.056	0.022
138	-0.060	-0.081
139	0.070	-0.014
140	0.082	-0.092
141	-0.131	-0.065
142	-0.057	-0.039
143	0.037	-0.098
144	0.062	0.062
145	0.119	0.004
146	-0.022	-0.161
147	0.059	0.015
148	0.024	0.059

Table 6: Time domain representation of the long sequences

3. Generation of the SIGNAL field

3.1. SIGNAL field bit assignment

The assignment follows Clause 17.3.4 and table 111. The transmitted bits are shown in Table 7 where bit 0 is transmitted first

###	Bit	meaning
0	0	LENGTH (LSB)
1	0	
2	1	
3	0	
4	0	
5	1	
6	1	
7	0	
8	0	
9	0	
10	0	
11	0	LENGTH (MSB)

###	Bit	meaning
12	1	RATE: R1
13	0	RATE: R2
14	1	RATE: R3
15	1	RATE: R4
16	0	Reserved
17	0	Parity
18	0	SIGNAL TAIL
19	0	SIGNAL TAIL
20	0	SIGNAL TAIL
21	0	SIGNAL TAIL
22	0	SIGNAL TAIL
23	0	SIGNAL TAIL

Table 7: Bit assignment for SIGNAL field

3.2. Coding the SIGNAL field bits.

The bits are encoded by the rate ½ convolutional encoder to yield the 48 bits given in Table 8.

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

Table 8: SIGNAL field bits after encoding

3.3. Interleaving the SIGNAL field bits.

The encoded bits are interleaved according to the interleaver of section 17.3.5.6. A detailed breakdown of the interleaving operation is deferred to section 6. The interleaved SIGNAL field bits are shown in Table 9.

##	Bit	##	Bit	##	Bit	##	Bit	##	Bit	##	Bit
0	0	8	1	16	0	24	1	32	1	40	0
1	1	9	0	17	0	25	0	33	0	41	0

The encoded and interleaved bits are BPSK modulated to yield the frequency domain representation given in Table 10

###	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	0.000	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	0.000	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	0.000	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	0.000	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

Table 10: Frequency domain representation of SIGNAL field

Four pilots subcarriers are added by taking the values {1.0,1.0,1.0,-1.0}, multiplying them by the first element of sequence $\boldsymbol{p}_{0...126}$, given in equation (25), and inserting into location {-21,-7,7,21} respectively. The resulting frequency domain values are given in Table 11.

###	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

Table 11: Frequency domain representation of SIGNAL field with pilots inserted

1	0.060	-0.089	21	0.110	-0.014	41	-0.032	0.063	61	0.087	0.029
2	-0.045	-0.112	22	-0.003	-0.033	42	0.136	0.019	62	0.200	-0.036
3	-0.061	-0.030	23	-0.101	-0.041	43	-0.023	-0.080	63	-0.085	-0.074
4	-0.058	0.014	24	-0.050	-0.072	44	-0.024	0.021	64	-0.031	-0.031
5	0.055	-0.069	25	-0.015	-0.117	45	-0.040	0.063	65	0.060	-0.089
6	0.055	-0.025	26	0.055	0.025	46	0.005	-0.086	66	-0.045	-0.112
7	-0.015	0.117	27	0.055	0.069	47	0.098	-0.059	67	-0.061	-0.030
8	-0.050	0.072	28	-0.058	-0.014	48	0.031	0.000	68	-0.058	0.014
9	-0.101	0.041	29	-0.061	0.030	49	0.098	0.059	69	0.055	-0.069
10	-0.003	0.033	30	-0.045	0.112	50	0.005	0.086	70	0.055	-0.025
11	0.110	0.014	31	0.060	0.089	51	-0.040	-0.063	71	-0.015	0.117
12	0.024	0.112	32	-0.031	0.031	52	-0.024	-0.021	72	-0.050	0.072
13	-0.081	-0.033	33	-0.085	0.074	53	-0.023	0.080	73	-0.101	0.041
14	0.054	-0.116	34	0.200	0.036	54	0.136	-0.019	74	-0.003	0.033
15	0.050	0.133	35	0.087	-0.029	55	-0.032	-0.063	75	0.110	0.014
16	-0.094	0.000	36	0.058	0.119	56	-0.138	-0.116	76	0.024	0.112
17	0.050	-0.133	37	0.130	0.091	57	-0.152	-0.075	77	-0.081	-0.033
18	0.054	0.116	38	-0.153	-0.047	58	-0.153	0.047	78	0.054	-0.116
19	-0.081	0.033	39	-0.152	0.075	59	0.130	-0.091	79	0.050	0.133
									80	-0.047	0.000

Table 12: Time domain representation of the SIGNAL field

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

4. Generating the DATA bits

4.1. Delineating, SERVICE field prepending, and zero padding

The transmitted message, shown in figure 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 36Mb/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 13 and Table 14. For clarity only the first and last 144 bits are shown.

##	Bit	##	Bit	##	Bit	##	Bit	##	Bit	##	Bit
0	0	24	0	48	0	72	1	96	0	120	0
1	0	25	0	49	0	73	1	97	0	121	0
2	0	26	0	50	0	74	0	98	0	122	0
3	0	27	0	51	0	75	0	99	0	123	0
4	0	28	0	52	0	76	1	100	0	124	0
5	0	29	0	53	0	77	1	101	0	125	0
6	0	30	1	54	0	78	0	102	0	126	0
7	0	31	0	55	0	79	1	103	0	127	1
8	0	32	0	56	0	80	0	104	0	128	0
9	0	33	0	57	1	81	0	105	0	129	0
10	0	34	0	58	1	82	1	106	1	130	1
11	0	35	0	59	0	83	1	107	0	131	1

Table 13: First 144 DATA bits

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

Table 14: Last 144 DATA bits

4.2. 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 15.

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

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

Table 16: First 144 bits after scrambling

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

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

Table 18: Coded bits of first DATA symbol

5.2. 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 19and the mapping from *i*, to *j* is shown in Table 20.

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

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

Table 19: first 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

Table 20: second permutation

As a specific example consider the case of k=17 (the 18th bit after encoding and puncturing). It is mapped by first permutation to i=13 and by the second permutation to j=12 (the 13th bit before mapping).
The interleaved bits are shown in Table 21.

##	Bit	##	Bit	##	Bit	##	Bit	##	Bit	##	Bit
0	0	32	0	64	1	96	0	128	0	160	0
1	1	33	1	65	0	97	0	129	1	161	1

15	0	47	1	79	1	111	1	143	0	175	0
16	1	48	1	80	0	112	1	144	1	176	0
17	0	49	0	81	1	113	1	145	0	177	1
18	1	50	1	82	1	114	1	146	1	178	0
19	0	51	1	83	1	115	1	147	0	179	1
20	0	52	0	84	1	116	0	148	0	180	1
21	1	53	0	85	1	117	1	149	1	181	0
22	1	54	1	86	1	118	0	150	0	182	0
23	1	55	0	87	1	119	0	151	0	183	1
24	1	56	1	88	1	120	0	152	0	184	1
25	1	57	0	89	0	121	1	153	1	185	1
26	1	58	0	90	1	122	0	154	1	186	0
27	0	59	1	91	1	123	0	155	1	187	0
28	1	60	0	92	1	124	1	156	0	188	0
29	1	61	0	93	1	125	1	157	0	189	0
30	1	62	0	94	0	126	0	158	1	190	0
31	0	63	1	95	1	127	0	159	0	191	1

Table 21: Interleaved bits of first data symbol

5.3. Mapping into symbols

The frequency domain symbols are generated by grouping 4 coded bits and mapping into complex QAM16 symbols according to Table 84. For instance, the first 4 bits (0 1 1 0) are mapped to the complex value -0.316+0.949j, inserted at subcarrierr –26.

Four pilots subcarriers are added by taking the values {1.0,1.0,1.0,-1.0}, multiplied them by the second element of sequence ***p***, given in equation (25) and inserted into location {-21,-7,7,21} respectively

The frequency domain is shown in Table 22.

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

0	SIGNAL	1	1.0 +0j	1.0 +0j	1.0 +0j	-1.0 +0j
1	DATA 1	1	1.0 +0j	1.0 +0j	1.0 +0j	-1.0 +0j
2	DATA 2	1	1.0 +0j	1.0 +0j	1.0 +0j	-1.0 +0j
3	DATA 3	1	1.0 +0j	1.0 +0j	1.0 +0j	-1.0 +0j
4	DATA 4	-1	-1.0 +0j	-1.0 +0j	-1.0 +0j	1.0 +0j
5	DATA 5	-1	-1.0 +0j	-1.0 +0j	-1.0 +0j	1.0 +0j
6	DATA 6	-1	-1.0 +0j	-1.0 +0j	-1.0 +0j	1.0 +0j

Table 23: Polarity of the pilot subcarriers

The symbols are appended one after the other with a one sample overlap.

7. The entire packet

The packet in its entirety is shown in Table 1. The short sequences section, the long sequences section, the SIGNAL field and the DATA symbols are separated by thick lines.

###	Re	Im
0	0.022	0.022
1	-0.109	-0.045
2	-0.044	0.062
3	0.013	0.126
4	-0.133	-0.044
5	-0.095	0.052
6	-0.018	0.062
7	0.075	-0.066
8	0.133	0.044
9	-0.042	0.071
10	-0.044	-0.062
11	0.013	-0.152
12	-0.044	-0.044
13	0.069	0.099
14	0.107	-0.062
15	0.075	-0.085
16	0.044	0.044
17	-0.109	-0.045
18	-0.044	0.062
19	0.013	0.126
20	-0.133	-0.044
21	-0.095	0.052
22	-0.018	0.062
23	0.075	-0.066
24	0.133	0.044
25	-0.042	0.071
26	-0.044	-0.062
27	0.013	-0.152
28	-0.044	-0.044

###	Re	Im
40	0.133	0.044
41	-0.042	0.071
42	-0.044	-0.062
43	0.013	-0.152
44	-0.044	-0.044
45	0.069	0.099
46	0.107	-0.062
47	0.075	-0.085
48	0.044	0.044
49	-0.109	-0.045
50	-0.044	0.062
51	0.013	0.126
52	-0.133	-0.044
53	-0.095	0.052
54	-0.018	0.062
55	0.075	-0.066
56	0.133	0.044
57	-0.042	0.071
58	-0.044	-0.062
59	0.013	-0.152
60	-0.044	-0.044
61	0.069	0.099
62	0.107	-0.062
63	0.075	-0.085
64	0.044	0.044
65	-0.109	-0.045
66	-0.044	0.062
67	0.013	0.126
68	-0.133	-0.044

###	Re	Im
80	0.044	0.044
81	-0.109	-0.045
82	-0.044	0.062
83	0.013	0.126
84	-0.133	-0.044
85	-0.095	0.052
86	-0.018	0.062
87	0.075	-0.066
88	0.133	0.044
89	-0.042	0.071
90	-0.044	-0.062
91	0.013	-0.152
92	-0.044	-0.044
93	0.069	0.099
94	0.107	-0.062
95	0.075	-0.085
96	0.044	0.044
97	-0.109	-0.045
98	-0.044	0.062
99	0.013	0.126
100	-0.133	-0.044
101	-0.095	0.052
102	-0.018	0.062
103	0.075	-0.066
104	0.133	0.044
105	-0.042	0.071
106	-0.044	-0.062
107	0.013	-0.152
108	-0.044	-0.044

###	Re	Im
120	0.133	0.044
121	-0.042	0.071
122	-0.044	-0.062
123	0.013	-0.152
124	-0.044	-0.044
125	0.069	0.099
126	0.107	-0.062
127	0.075	-0.085
128	0.044	0.044
129	-0.109	-0.045
130	-0.044	0.062
131	0.013	0.126
132	-0.133	-0.044
133	-0.095	0.052
134	-0.018	0.062
135	0.075	-0.066
136	0.133	0.044
137	-0.042	0.071
138	-0.044	-0.062
139	0.013	-0.152
140	-0.044	-0.044
141	0.069	0.099
142	0.107	-0.062
143	0.075	-0.085
144	0.044	0.044
145	-0.109	-0.045
146	-0.044	0.062
147	0.013	0.126
148	-0.133	-0.044

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
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	0.062	-0.016	340	0.024	-0.112	360	-0.138	0.116	380	0.058	-0.119
321	0.060	-0.089	341	0.110	-0.014	361	-0.032	0.063	381	0.087	0.029
322	-0.045	-0.112	342	-0.003	-0.033	362	0.136	0.019	382	0.200	-0.036
323	-0.061	-0.030	343	-0.101	-0.041	363	-0.023	-0.080	383	-0.085	-0.074
324	-0.058	0.014	344	-0.050	-0.072	364	-0.024	0.021	384	-0.031	-0.031
325	0.055	-0.069	345	-0.015	-0.117	365	-0.040	0.063	385	0.060	-0.089
326	0.055	-0.025	346	0.055	0.025	366	0.005	-0.086	386	-0.045	-0.112
327	-0.015	0.117	347	0.055	0.069	367	0.098	-0.059	387	-0.061	-0.030

401	0.043	0.065	421	-0.072	0.054	441	0.022	-0.134	461	0.058	0.022
402	-0.063	-0.014	422	0.023	0.098	442	0.046	-0.087	462	0.035	0.000
403	-0.073	-0.071	423	-0.018	-0.171	443	0.010	0.108	463	-0.071	-0.031
404	-0.050	0.028	424	0.044	-0.086	444	0.060	0.083	464	0.059	-0.018
405	-0.043	0.129	425	0.080	0.052	445	0.054	0.104	465	0.043	0.065
406	0.053	0.115	426	0.020	-0.070	446	0.032	-0.094	466	-0.063	-0.014
407	0.139	-0.058	427	-0.016	0.115	447	-0.033	-0.123	467	-0.073	-0.071
408	0.038	-0.058	428	-0.143	-0.020	448	-0.011	0.168	468	-0.050	0.028
409	-0.009	0.030	429	-0.066	-0.166	449	0.014	0.082	469	-0.043	0.129
410	0.005	-0.054	430	0.034	0.146	450	-0.027	-0.048	470	0.053	0.115
411	0.016	0.031	431	-0.122	-0.016	451	0.112	-0.093	471	0.139	-0.058
412	-0.103	0.187	432	-0.237	-0.081	452	0.117	-0.080	472	0.038	-0.058
413	-0.127	0.084	433	-0.045	0.075	453	0.077	0.061	473	-0.009	0.030
414	0.141	-0.018	434	0.064	-0.084	454	-0.007	0.057	474	0.005	-0.054
415	0.027	0.066	435	-0.162	-0.013	455	-0.128	0.097	475	0.016	0.031
416	-0.048	0.049	436	-0.110	0.028	456	0.055	0.066	476	-0.103	0.187
417	0.126	-0.148	437	0.030	-0.040	457	0.015	-0.110	477	-0.127	0.084
418	-0.002	-0.102	438	0.006	-0.067	458	-0.042	-0.093	478	0.141	-0.018
419	0.014	0.094	439	0.071	-0.123	459	0.075	0.028	479	0.027	0.066
480	-0.004	0.090	500	-0.044	-0.090	520	-0.097	0.027	540	-0.102	-0.042
481	0.001	0.099	501	0.014	-0.038	521	0.121	-0.156	541	0.040	0.117
482	0.013	-0.050	502	0.001	-0.044	522	0.067	-0.055	542	0.062	0.075
483	-0.013	-0.021	503	-0.074	0.134	523	-0.105	0.004	543	-0.017	0.091
484	-0.093	0.074	504	-0.042	0.236	524	0.063	-0.142	544	0.040	0.130
485	-0.072	0.049	505	0.137	0.027	525	0.045	-0.056	545	0.001	0.099
486	-0.065	0.048	506	0.135	-0.041	526	0.056	-0.086	546	0.013	-0.050
487	-0.012	0.044	507	-0.020	0.007	527	0.131	-0.016	547	-0.013	-0.021
488	0.018	0.052	508	-0.030	0.019	528	0.018	0.049	548	-0.093	0.074
489	0.025	-0.039	509	-0.083	0.048	529	-0.062	-0.066	549	-0.072	0.049
490	0.029	0.010	510	-0.036	0.075	530	-0.017	0.034	550	-0.065	0.048
491	-0.074	0.154	511	0.014	0.002	531	-0.013	0.001	551	-0.012	0.044
492	0.029	0.007	512	-0.040	-0.091	532	-0.059	-0.084	552	0.018	0.052
493	0.167	-0.067	513	0.079	0.014	533	0.077	-0.104	553	0.025	-0.039
494	0.047	-0.025	514	-0.079	0.082	534	0.061	-0.034	554	0.029	0.010
495	0.098	0.020	515	-0.094	-0.120	535	-0.153	0.106	555	-0.074	0.154
496	0.179	-0.010	516	0.157	-0.137	536	-0.156	-0.157	556	0.029	0.007
497	0.057	-0.113	517	-0.142	0.117	537	-0.088	-0.148	557	0.167	-0.067
498	0.033	0.028	518	-0.205	0.069	538	0.056	0.070	558	0.047	-0.025
499	0.003	0.025	519	-0.033	0.002	539	0.046	-0.115	559	0.098	0.020
560	0.045	0.070	580	-0.137	-0.055	600	-0.086	0.173	620	0.075	-0.094
561	-0.041	-0.019	581	-0.146	-0.068	601	-0.065	0.029	621	-0.010	-0.003
562	0.067	-0.025	582	0.014	0.072	602	0.087	-0.035	622	-0.043	0.108
563	-0.037	0.031	583	0.000	-0.120	603	0.075	-0.032	623	0.024	0.158
564	-0.124	0.016	584	0.028	0.014	604	-0.022	0.000	624	-0.089	0.150
565	-0.024	-0.075	585	0.064	0.089	605	0.075	0.048	625	-0.041	-0.019
566	0.061	-0.112	586	-0.006	-0.020	606	0.015	-0.038	626	0.067	-0.025

640	0.040	-0.085	660	0.006	-0.014	680	0.072	0.033	700	0.068	0.090
641	0.134	0.034	661	-0.012	-0.122	681	-0.043	0.013	701	0.017	-0.092
642	0.068	-0.047	662	-0.029	0.006	682	-0.022	0.116	702	-0.005	0.098
643	0.062	-0.033	663	-0.095	-0.039	683	-0.027	-0.017	703	-0.033	0.055
644	0.130	0.109	664	-0.002	-0.030	684	0.101	-0.020	704	0.020	-0.130
645	0.007	-0.112	665	0.035	0.098	685	0.069	0.051	705	0.134	0.034
646	-0.016	-0.171	666	-0.108	-0.070	686	-0.032	0.041	706	0.068	-0.047
647	-0.001	0.065	667	0.033	-0.055	687	0.101	0.112	707	0.062	-0.033
648	-0.112	0.105	668	0.141	0.043	688	0.071	-0.079	708	0.130	0.109
649	0.005	-0.033	669	0.002	0.028	689	-0.027	-0.089	709	0.007	-0.112
650	0.091	-0.019	670	0.006	0.000	690	0.017	0.011	710	-0.016	-0.171
651	-0.033	0.137	671	0.060	-0.047	691	0.005	-0.078	711	-0.001	0.065
652	-0.033	0.125	672	0.000	0.091	692	-0.073	-0.016	712	-0.112	0.105
653	0.077	0.019	673	-0.065	0.068	693	-0.030	-0.087	713	0.005	-0.033
654	0.155	0.034	674	-0.138	0.000	694	0.118	-0.090	714	0.091	-0.019
655	-0.001	-0.065	675	-0.118	0.089	695	0.102	-0.046	715	-0.033	0.137
656	-0.170	-0.079	676	0.055	0.001	696	0.042	-0.069	716	-0.033	0.125
657	-0.144	0.112	677	-0.019	-0.099	697	-0.008	0.052	717	0.077	0.019
658	-0.172	0.064	678	-0.117	-0.074	698	-0.131	-0.054	718	0.155	0.034
659	-0.098	0.025	679	0.091	0.044	699	-0.048	0.011	719	-0.001	-0.065
720	-0.085	-0.055	740	0.207	0.041	760	0.129	0.009	780	-0.039	0.089
721	-0.010	0.102	741	-0.042	-0.063	761	-0.085	-0.035	781	0.024	-0.011
722	0.138	0.110	742	-0.043	-0.056	762	0.021	-0.055	782	0.123	0.020
723	0.103	-0.026	743	0.029	0.040	763	0.173	-0.043	783	0.005	0.043
724	-0.076	0.053	744	-0.081	0.018	764	-0.134	-0.026	784	0.000	-0.031
725	-0.005	0.058	745	-0.068	-0.016	765	-0.137	-0.006	785	-0.010	0.102
726	-0.001	0.061	746	0.005	-0.003	766	0.014	-0.103	786	0.138	0.110
727	-0.017	0.078	747	0.081	-0.203	767	-0.085	-0.051	787	0.103	-0.026
728	-0.069	0.011	748	0.006	-0.202	768	0.100	-0.010	788	-0.076	0.053
729	-0.077	0.006	749	-0.097	0.100	769	0.158	-0.135	789	-0.005	0.058
730	0.047	-0.030	750	-0.103	0.151	770	-0.022	0.038	790	-0.001	0.061
731	0.106	-0.030	751	-0.042	0.016	771	-0.008	0.074	791	-0.017	0.078
732	0.129	-0.059	752	0.040	-0.087	772	-0.117	-0.024	792	-0.069	0.011
733	-0.030	-0.130	753	-0.094	-0.069	773	-0.047	0.108	793	-0.077	0.006
734	-0.113	-0.107	754	-0.106	0.032	774	0.043	-0.021	794	0.047	-0.030
735	-0.047	-0.068	755	0.041	0.039	775	-0.085	-0.022	795	0.106	-0.030
736	-0.021	0.010	756	0.026	0.048	776	0.061	0.160	796	0.129	-0.059
737	0.038	0.003	757	-0.016	0.056	777	0.012	0.031	797	-0.030	-0.130
738	-0.065	-0.028	758	-0.079	-0.023	778	-0.017	0.015	798	-0.113	-0.107
739	0.051	0.059	759	0.032	-0.036	779	0.138	0.130	799	-0.047	-0.068
800	0.004	-0.016	820	-0.031	0.013	840	0.064	0.016	860	-0.069	-0.025
801	0.023	-0.112	821	-0.028	-0.046	841	-0.053	0.100	861	-0.098	-0.038
802	0.014	0.078	822	0.177	-0.002	842	-0.064	-0.034	862	-0.126	-0.060
803	-0.050	-0.198	823	0.035	-0.035	843	-0.004	-0.016	863	-0.070	0.116
804	-0.059	-0.037	824	-0.130	-0.114	844	-0.024	0.080	864	0.030	-0.041
805	0.112	0.236	825	0.041	0.097	845	-0.039	-0.015	865	0.023	-0.112

819	0.044	-0.153		839	0.126	0.026		859	-0.001	0.000		879	-0.045	-0.049
												880	0.014	-0.593

Table 24: The entire packet