TSG-RAN Working Group 1 AH21 **TSGR1(00)0837**

Espoo, Finland, June, 14-15, 2000

Agenda Item: AH21
Source: CWTS
To: TSG RAN WG1
Title: modulation and spreading
Document for: Discussion and Approval

Introduction

This file describes modulation and spreading for low chip rate TDD option.

Conclusion

It's proposed to discuss and include the following text proposal into the clause 9 modulation and spreading of TR25.928.

---------- changes to TR25.928 begin ----------

[Description:]

This document is described the difference of modulation and spreading in low chip rate TDD. The main difference is the mapping of bits onto signal point constellation, synchronization codes and code Allocation.

[Rational:]

9.1.2 Mapping of bits onto signal point constellation

9.1.2.1 QPSK modulation
The same with 3.84Mcps TDD.

9.1.2.2 8PSK modulation
The data modulation is performed to the bits from the output of the physical channel mapping procedure for 8PSK service 3 consecutive binary bits to a complex valued data symbol. Each user burst has two data carrying parts, termed data blocks:

$$\underline{\mathbf{d}}^{(k,i)} = (\underline{d}_1^{(k,i)}, \underline{d}_2^{(k,i)}, ..., \underline{d}_{N_k}^{(k,i)})^{\mathrm{T}} \quad \mathrm{i} = 1, 2; \mathrm{k} = 1, ..., \mathrm{K}. \tag{1}$$

N_k is the number of symbols per data field for the user k. This number is linked to the spreading factor Q_k.

Data block $\underline{\mathbf{d}}^{(k,1)}$ is transmitted before the midamble and data block $\underline{\mathbf{d}}^{(k,2)}$ after the midamble. Each of the N_k data symbols $\underline{d}_n^{(k,i)}$; i=1, 2; k=1,...,K; n=1,...,N_k; of equation 1 has the symbol duration $T_s^{(k)} = Q_k . T_c$ as already given.

The data modulation is 8PSK, thus the data symbols $\underline{d}_n^{(k,i)}$ are generated from 3 consecutive data bits from the output of the physical channel mapping procedure:

using the following mapping to complex symbols:

Consecutive binary bit pattern	complex symbol
$b_{1,n}^{(k,i)}\ b_{2,n}^{(k,i)}\ b_{3,n}^{(k,i)}$	$\underline{d}_n^{(k,i)}$
000	Cos(11pi/8)+sin(11pi/8)
001	Cos(9pi/8)+sin(9pi/8)
010	Cos(5pi/8)+sin(5pi/8)
011	Cos(7pi/8)+sin(7pi/8)j
100	Cos(13pi/8)+sin(13pi/8)
101	Cos(15pi/8)+sin(15pi/8)
110	Cos(3pi/8)+sin(3pi/8)1
111	Cos(pi/8)+sin(pi/8)

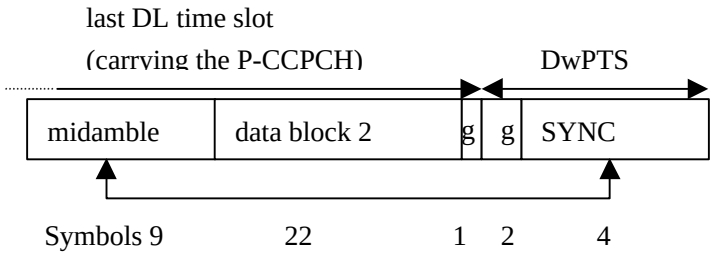
The mapping corresponds to a 8PSK modulation of the interleaved and encoded data bits $b_{l,n}^{(k,i)}$ of the table above and $\underline{d}_n^{(k,i)}$ of equation 1.

The use of shifted 8PSK is under consideration.

9.3 Synchronisation codes

9.3.1 DwPTS code

The DwPTS is composed of 64 chips (4 symbols) of SYNC and 32 chips (2 symbols) of guard period as shown in Figure 1. SYNC code is not scrambled.



31.5 symbols (393.75 μs)

Figure 1: The frame structure around DwPTS

The phase of the whole DwPTS is used to signal the P-CCPCH ~~interleaving period~~ multi-frame. As QPSK is used for the modulation of the DwPTS, the phases 45, 135, 225, 315° is used to signal. Indication of starting point of the ~~interleaving frame~~ phase quadruple and the position of the BCH is realised by means of direct signalling. In this method the phase of 45 ° is reserved for the beginning of ~~the interleaving period~~each phase quadruple. For the other sub-frames of the ~~interleaving frame~~phase quadruple, the phase 135 °, 225 ° and 315 ° are used only to detect the position of the BCH as shown Table 1.

The sequence of the phases is chosen, that the position of the BCH can also be detected by using differential demodulation of the consecutive phases of the DwPTS.

Table 1 Sequence for the phase modulation for the DwPTS

Phase quadruple	# 225	~~Interleaving frame number~~(SFN/2) mod 8
45, 225, 225, 225	3	~~1~~0 (the BCH should be here)
45, 135, 135, 225	1	~~2~~1
45, 135, 225, 135	1	~~3~~2
45, 315, 225, 315	1	~~4~~3
45, 225, 135, 315	1	~~5~~4
45, 225, 315, 315	1	~~6~~5
45, 225, 225, 135	2	~~7~~6
45, 225, 225, 315	2	~~8~~7
~~45, 135, 225, 225~~	~~2~~	~~9~~
~~45, 315, 225, 225~~	~~2~~	~~10~~
~~45, 225, 135, 225~~	~~2~~	~~11~~
~~45, 225, 315, 225~~	~~2~~	~~12~~
Others	-	Error

There should be 32 different SYNC codes (see Table A) for the whole system. That the (SFN/2) mod 8= 0~~1~~ is always used for BCH. Other position ~~interleaving frames~~ can also be configured to transmit the BCH.

9.3.2 UpPTS code

Synchronisation sequences for the UpPTS (SYNC1)

SYNC1 code is not scrambled.
The time slot is composed of 128chips of SYNC1 and 32chips of GP as shown in Figure 2.

There should be 256 different SYNC1 codes (see Table B) for the whole system.
The possible restriction to the network planning from parameter grouping is to be verified.

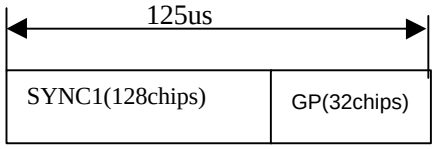


Figure 2 Burst structure of UpPTS

9.3.3 Code Allocation

Relationship between the SYNC and SYNC1 sequences, the scrambling codes and the midamble codes

Code Group	**Associated Codes**			
	SYNC ID	**SYNC1 ID (coding criteria)**	**Scrambling Code ID (coding criteria)**	**Basic Midamble Code ID (coding criteria)**
Group 1	0	0~7 (000~111)	0 (00)	0 (00)
			1 (01)	1 (01)
			2 (10)	2 (10)
			3 (11)	3 (11)
Group 2	1	8~15 (000~111)	4 (00)	4 (00)
			5 (01)	5 (01)
			6 (10)	6 (10)
			7 (11)	7 (11)
. . .				
Group 32	31	248~255 (000~111)	124 (00)	124 (00)
			125 (01)	125 (01)
			126 (10)	126 (10)
			127 (11)	127 (11)

Table A

SYNC Codes

Code ID	SYNC Codes of length 64
0	B3A7CC05A98688E4
1	9D559BD290606791
2	2CE7BA12A017C3A2
3	34511D20672F4712
4	9A772841474603F2
5	9109B1A5CE01F228
6	8FD429B3594501C0
7	25251354AA3F8C19
8	C9A3B8E0C043EA56
9	BA04B888E5BC1802
10	A735354299370207
11	74C3C8DA4415AE51
12	F4FD0458A0124663
13	A011D4E16C3D6064
14	BDA0661B0CAA8C68
15	8E31123F28928698
16	F095C1632E2906AB
17	B60B4A8A664071CF
18	AA094DCCE91E041A
19	C0C31CDA8A256807
20	D516964FB18C1890

21	30DE01834F4AACCE
22	8F700323BA5CAD34
23	1B50F4DEE0C1380C
24	443382164F56F2D1
25	E1E4005D49B846B4
26	040A97165330BFAA
27	C48E26881693AD78
28	D4354B2FE02361CC
29	5383AB6C8A10CE84
30	D417A730F2F12244
31	ABF0A0D905A939C4

Table B

SYNC1 Codes

Code ID	SYNC1 Codes of length 128
0	C11C20F0D1807DB8859175B798EC094A
1	91278068081EC8E74543DBC1C9AD4235
2	38F5AEE2E513DB12A663BA04160103E5
3	7AA8A0A210F12A1E4332F2EDD33011FC
4	C180EA3B9BA1774EB9611BD249C4A508
5	B072A2C839489D496B98CE9D0132FBC9
6	B2723EAC6EB01667F2B33961C8074234
7	C4144AD060F0EC095E227B92CF7C8280
8	653036A10D3054146FCF815986C63A14
9	F899CA61435D64DC07FDF04C4A0C053A
10	B56F2D6893A8051407F4C341D88DC7DC
11	DC0BE838242142EDE6413A72C88D74AA
12	22A2FD86E4086C70A4860B13C76E579F
13	A3CBC21322C97D2A02728E7875F39588
14	D4EC4F694A082CB38E3B1558A0FCC89F
15	CC891141C4E216D235C15CF5D3F9B002
16	A1993114C50B77CB0C0725D1E22FD016
17	24F73A979DE52F82E8800CCB93842A59
18	8F878FA04659842E294D8DEAB20BA2FD
19	AC90B0442D70662B028CF76A6BECDF09
20	D94A284DF64D7B0102F0E084C29C88C8
21	8603200C7596F24E865FD3815693358D
22	B466B12CF433642BD8B08F1F452E0550
23	86A3A1772C1C99FCA7DBBA0C312E34A0
24	622A1889F72A9A2C042D46F08EFEE1AC
25	BF220A362BC0D3B0D7CE400954C6CFAE

26	D28D73C52E89CF57905C502244F63616
27	AD4E1C2103697D64D8B9D4C035D90548
28	8F081A9BA12B6C6BD024531AA984D21C
29	E4092429BE82988E1E3585BF6A6AE550
30	08BD36E0A9C061782CB38B35B335CA56
31	1CDFF3CC2685D1C44F4A1059AB03F40A
32	506ED4E88FB1CECE3243F2A27A0221A4
33	846CF58A7AB613C83A24130B5778C0E2
34	A2711A99E26A0C75AC026F4CFAECE893
35	D846EEEBA2432AC05A01043C62579DCF
36	6B16B4E851CAF2121FC4CF88820C89E7
37	AA4889A78207674A74E10C6F2BE11D48
38	8534CF8145BC991052814ED5C72709EE
39	01AEF15D2290A84A607425746D9963C7
40	999188F758245D5164FE16D852942C71
41	CF71C008599287E446E30745BD56E2D2
42	248414BA0DF8CDC4711FE7C8707ED0AD
43	EB2E263EC016191C81AB714BFE4D2B30
44	862082A7482FAC1C499793A0D8CED670
45	DE2C22B2783AB75A7342608DE413840A
46	E31AA60B727F2CA2A78DAAC10665011D
47	CEF6CD06509870AC9E0177ACD550921D
48	E52C84D499FFCDC287581691471540F2
49	B33BF6551A4322504BEE0930BCA1EC68
50	555BE6886D0FC43D72315E6C6D384148
51	8444F67451EE23CE1240C90F0B52A492
52	5C290D28E84060E69D09788A261B10FF
53	337E0C35E83CD38CCC5D45804241F952
54	A7879F0D31A8982A01EE6AC4952984DC
55	A37F506508928C70A83D69A2373781B9
56	42F55208EE12909803A7CBEB19B5419E
57	57E5E268A328FCC9ED04B9E5420AC702
58	EB033AD1222F84D8642C4E3FAAD28206
59	98EE1415F026AC0E862C520451697DD0
60	6A0528AEA4B7CD6702660D81F8821E19
61	763D626A87C603BCB09E1A4C800A378F
62	EEA61897879289340C23F669D6A03762
63	A6571B3CC2D0E04F017ACC808B92DCE7
64	DDF88B52EA1831D293A803CF23C8C471
65	6CA4D333A2684140475DAB491F61C17A
66	A7D2AD23043989A13289F7C3E135580A
67	B1C752FA66B41C81904EDE27EA000E2E
68	8694BE3CC1CB36BE2A095F89CC619080

69	9C20334E1BBC596B25E151180BF99940
70	484256214F81070DD9C49A2B05A43DCE
71	401A20BCBE29B7438A7AEE44635A9E23
72	8858585C3239CBF628033FA0DF189378
73	EFA36404C1BA5118CC5F9052FD28D9C3
74	155609873D8A042D496E6477B747C4F8
75	8446077883A6D7D2549CC9742E3FD023
76	E630142B189AA209371A6F0FFDBC30A7
77	C46060535AC6DBB2095F1D7826D0CD5C
78	E00D19E48797148B28DEDA9D429362E2
79	645DE447E938485489416CAFCC1C571F
80	DA10AFBF2AE61C593A1D88584DE30598
81	BB248AEA5FD3FE210CD48FC401E1A686
82	A89F146BD9191F445301C081CB6F5625
83	15BBF04F247C59150208949EB6B9CC58
84	08F48BFA7804B5B2CC2E96510232E062
85	9AA2BE74005A3679C626B209580B8D03
86	9D40664A2C808F2F293E255398B37E6A
87	6869C98A8AAD81CAE41A23C83FF9EEA0
88	576E8948E61BD0927C4140C3C04C4CF3
89	0F942C67A1137B6EAA058C2A74872C73
90	9D058E27ED546C10632684BBC84E5BC1
91	79D4B840E20148B134F90B51164BCBD0
92	0E35E1D8D1214C05FAC790B69B239150
93	FFA1BB0232CD71480BE5CA1C2A269F89
94	B2956F5F4E270446F9211584792628DB
95	F56CCA23421C8EC8F8A41F7DA4A41EA2
96	0B5ECA04F1789A7148C80C39D57D05F6
97	A10B538E8A8CFC8F8925C485F2A88660
98	9925C2C715001D9FC78ACCC51DA1AF34
99	0DAC9CFDEA40429A8B12C7D320D60F70
100	377FC9A097017958440914E83118E39D
101	8421096FA8B47E4E943B6473671955CC
102	574086183477C4F68540CB7E858263B1
103	895B6A8980C6703C779F49F40C5CFC19
104	D0D253E157BC19262150CEA668679E71
105	B8889C60EBA812BD7F0B6498823296D2
106	A13FB9F3A08528E44B13C12CF0D461AA
107	8D4DCFBE43D6E2024B1F8470224AA330
108	536D159E119E0893838657B12A074E64
109	DCFD49C504AD3A2F049A0CB70238EC8A
110	D363DB4C46C11757FA8FB18139789102
111	424A1E8A1D4DA256E4CA3BC8C2201BE3

112	417B619ED30FEB0A847CC3A191A20398
113	843FBBC95453C61786D1332612B45B4D
114	F26CACC0732CF8ED0C5BC1462B1620B4
115	88E0FE440C70E9249A92A7AF94638880
116	99A52B7D8C950308057E0661D7459960
117	A5C28218BF5D16E63E42698A0A6B0896
118	B2763BEEC784A12E8C50778536921806
119	987B2B6A3A77A059B30A082457AB84E0
120	820DB500F1B206358D7A7F210AB85AA8
121	97760A5CFC5E03EB439C914590045938
122	896A720E8857C8708A59F8C94DE0841E
123	2D101F0CF95263843412577340DEBB11
124	E8E5214B4DCF5D11A245B0149D49C87C
125	51224EAA10099ACDE384834A5ADF03D8
126	64E51253554A230C186FDE4E8781BC09
127	A499E391E69ED08890AC1A82A6115BEC
128	EE54C6E1834210D3EC1B07A456B92AA8
129	949DB5CA82420B54C1E0BCC111E704D9
130	9439EE9A9E4C447D1AA350926495047F
131	AD095CC0E7438AECE38D60980B3F2D00
132	83089C254C5EE9788072BC3D9282F798
133	A27DC1A457BC5A56563D8A9B11203615
134	713053A9C0B1B08B14705FF5A7244DB4
135	D36D4B9F4007354E0EC1B0CA8C8C7124
136	82E7C990612114F1CCE1BD9509FD4386
137	C8D83FF0B48B14830D2015D53F8C0672
138	08AF223C869A36B169148FDDABB7D120
139	B6C284C600AD0A99F86C449F8F4C53A6
140	DC741B320C07682AF92AC4DBDE0C28C2
141	89B8D84FA902265850C0FA6FF0EB2C4F
142	A69445B3A52201DB984BC03D1956D7F3
143	0FE0F7224B7AD72E4D4530D0223F590C
144	1B8C06F051434048EB925133AD3BD3F9
145	E133D4C3C942726A351300C37E55D0DF
146	9E09481D1881A66F562D8B453BC83AB2
147	2397B04B60A3C5700907BDBBA4E818C8
148	8F81F7A08CC6C8DA3D692AD34F50C012
149	9AB325352981BCCFA072F8FDE3009221
150	4FA88B7F1F8A620C31B0D486C52AC2F6
151	097AF0ADD16D7D39851049F0130EE444
152	A5027732DACFF11C388D5820A4A9BA49
153	1CD981EA2EDB46218A407C7E20D4BE84
154	D0FD94279FA67EC61A3904C0AD8ACA04

155	EA73A9415EC2004D49E9D0F645961C75
156	005AF0614A7552041194DEECBF8DD016
157	B514481533DA0A731705B93CF634E40D
158	983054521841A6E4FF34B2C07B5684FE
159	C46D927D0FD2B2F509550025677C6871
160	2AD85C08127487C87ECE014D65169102
161	0F617852FA3930AA7EE74B400B2CC831
162	AE9D395004C6E27540C378625D36E0D6
163	DC4FA55750F10B0636248F12C212FFE4
164	D3602B8D6CBF1809C88B827185631ECF
165	A94825850708E7723EA8F22C44BF78B2
166	A62D231C16AEEFE0B0026B306662945A
167	9C7BE810A86465A50551F89125D93B12
168	9712D9338B9CC60485C10172F50F121F
169	A3902CE0E0B9912591FF28C695728257
170	4167057891AB29473A9E0F67F3658921
171	B3368B91EC12A284BC414C8F0D7F8D20
172	EE21888101ABF06C1175828CB58B598D
173	E43923A00ECC32CCC2D162A4A44BD7F4
174	CC9E30B8538AD51703EEB6F70801AB22
175	B908AD2F1501DA1C156811736CD798CD
176	2B46302ACCC2F808797FC648A614326D
177	8A54494F1BE27235B8764023AA0FBCFA
178	BC1041E6F636421E89277DC154439103
179	275B39A63029B974E3561AE0A8FC8032
180	9283F6FE819B80492A22B85CE5CE5DC4
181	4CCB52C0CE058A78022C22DF5788CBCC
182	B0DF9608DE549A6F6C581516919A81E6
183	2CA185163CC36060D1E85BB0A7FBB988
184	66101D2846155CAC986FC790D2124EFC
185	8016E3904644D2093579B83BD7AB5071
186	531CAB7085BEC14257439658023647CF
187	DF2910165AA5051E41F6EB198E4D491C
188	BA32052042B0FB2188DE7857DA1B6788
189	9E6D075AFF0EA4153615E140BF380666
190	9ACC5A037902534642A3BE391AA40F9B
191	4D741A3B4499843010D7E5FA8988DC80
192	FA1421C96EDC6092726154560B1C2FC8
193	882946076223CAE0B0BFE3EDA59826D5
194	CEBB288C28B7472A0D3917012276C034
195	BD35A6E00C9528DB38289CF823C34F30
196	E2C93618B6B2800D51171A5F85746A55
197	B43EF39A1A64F0E220AF740F9494291B

198	AC537817C2612744A58132A8AFBC44A3
199	98A321249A821DDBF81C38235A371A14
200	AE1D46069090D81BB6B08FED9E687285
201	7EAE2415DC2CD60AE083249A33B56E05
202	3D942AAA9BC9F27289421CE0B301FB98
203	1548BA6D08530727AC6D059C005C6C42
204	FF47C21142C65B502DA70647BAE831D1
205	C83AA7FEAC5E51A08091E10DB0C233D9
206	E86EDD2EC2DAA3104229EDC43471A16A
207	22FAFB9C184B78B56EE91B6602C03244
208	E45631DC509B1290C08D2C1A1F15DBFE
209	D203C51207092B56568FDAD9E2D44473
210	2AA87F31A7D1AB1C90024F936006C4A5
211	913136153593DEABC7305BF0C5A62180
212	D8DA5FE401F2758642A082C53A6A5CB8
213	23C2295213147F324DE8EC1C103BAE88
214	883AF097FCDE82B366A1844245E0D727
215	79E5E9F8C933159ACADC22A06F900A70
216	FE40502B44A9E44B2C336250D47538CC
217	670452E19172C843176F1278FE41D584
218	B7EAA436078E6886A3024F593AD57580
219	1044D4CDD7230E7B1953AD1232DF07E2
220	4D821ECAC3D845A2E1011695624576FF
221	96622ED2FBD44D1B859D70601999F438
222	CCC31C3D6D5B41B8D82FF4522A4C0146
223	4A84F7CD62E0C712980E6A0C89BF394F
224	10E56751F000927284DBE174E68ECC4C
225	A3DE70921356F026E084CFE302A210A9
226	B12DA0621B343A8C3FE941A32EA5D571
227	D653135DE825A74B743E275C19020C71
228	5CAD301BF846B2EE921D33A3D4BB1220
229	1292445ACBB548C668FC3853578474E6
230	B94B4B89C0654688C9E007D9061DF5FE
231	75A2C91E76061A8680884E8BFD14A64A
232	83726F3070B47ECE21504A5065D74A36
233	964A471444A270840919F7FE07382D14
234	A582701EBFCA899B8497088C3560F300
235	64FCB63E21CAC63002D1E09FD1543274
236	B1E1C83F689ADF422C865F98D288838A
237	A06A0D822165D3F3416B47419ECCB547
238	1D2068039A32B7EF728914ECE07CB416
239	64C0CF81F78E8823ECC8661A5295422A
240	902A7243F593F2180E5A306A8438E6A9

241	A4CCED356D56BF1B41C28E1504301FE8
242	82AE90E2F76B3055A2E3A966025CC01A
243	8B90D5A62364E18574145C5895CEFF60
244	43F7EA1AB0D19032551AD9DE21307353
245	DD5D8424AC60360B1C14E65815C9B15E
246	C632A67382ECB2681DFB8525140E2878
247	3A6ACF212B6F8B9C53FF224C2E00C16C
248	86A90C267B1171093F362FE5CB14E3A0
249	EA262EC36E6589C3BB005426AF2590F4
250	200F03126C5B0D7B901128E7757C5F70
251	68FC090C2221AA98BF0D24E85066EFC2
252	9E26CEC67832FC42A87E92FA1015212E
253	ACD889634F79506F2582EA03240F2A07
254	AA65407E1F4A33BF9A62860A3D6A4CC0
255	B1B950AC76A608AA32D04B03C7FF24D3

[Explanation difference:]

For low chip rate have different frame structure. It has the special time slot DwPTS and UpPTS to estimate the UL-synchronization and Cell search. So the Sync and Sync1 code is needed in low chip rate ~~in low chip rate~~ TDD.

---------- changes to TR25.928 end ----------