TSG R1(99)F38

TSG-RAN Working Group 1 meeting#7bis
Kyoungju, Korea, Oct. 4-5, 1999

Agenda Item:

Source: **CWTS WG1**

Title: **CWTS specification TS C102**

Document for: Consideration

TS C102 V2.1.0 (1999-10)

Technical Specification

China Wireless Telecommunication Standard (CWTS); Working Group 1 (WG1); Physical channels and mapping of transport channels onto physical channels;

CWTS

Content

1 Scope

This document describes the burst structure in physical channels and mapping of transport channels onto physical channels in TD-SCDMA RTT.

2 References

[1] B. Steiner, P. Jung: Uplink channel estimation in synchronous CDMA mobile radio systems with joint detection. The fourth International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC'93), Yokohama, Japan, September 8-11, 1993.

[2] CWTS TS C105 "Physical channels and mapping of Transport channels onto physical channels (TDD)"

[3] CWTS WG1 1999/xxx, "Method and Principle of Uplink Synchronization Used in TD-SCDMA RTT"

[4] CWTS TS C103 "Multiplexing and channel coding"

[5] CWTS TS C104 "Spreading and modulation"

3 Definitions and abbreviations

<Editor's note: This section covers TDD relevant abbreviations only. >

BCH	Broadcast Channel
CCPCH	Common Control Physical Channel
CDMA	Code Division Multiple Access
DL	Downlink
DPCH	Dedicated Physical Channel
DRX	Discontinued Receive
DTX	Discontinued Transmit
DwPTS	Downlink Pilot Time Slot
FACH	Forward Access Channel
FDD	Frequency Division Duplex
FEC	Forward Error Correction
GP	Guard Period
GSM	Global System for Mobile Communication
GP	Guard Period
NRT	Non-Real Time
ODCH	ODMA Dedicated Transport Channel
ODMA	Opportunity Driven Multiple Access
ORACH	ODMA Random Access Channel
PCH	Paging Channel
PDU	Protocol Data Unit
PRACH	Physical Random Access Channel
PSCH	Physical Synchronisation Channel
RACH	Random Access Channel

RLC	Radio Link Control
RT	Real Time
RU	Resource Unit
SACCH	Slow Associated Control Channel
SCH	Synchronization Channel
SDCCH	Stand-alone Dedicated Control Channel
SS	Synchronisation Shift
TCH	Traffic Channel
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TD-SCDMA	Time Division Synchronous CDMA
UL	Uplink
UpPTS	Uplink Pilot Time Slot

4 Transport channels

4.1 Transport channels

The chapter describes transport channels that are required for data transfer. Transport channels are the services offered by layer 1 to the higher layers. A general classification of transport channels is two groups:

- common channels (where there is a need for in-band identification of the UEs when particular UEs are addressed)
- dedicated channels (where the UEs identified by the physical channel, i.e. code , time slot and frequency)

4.1.1 Dedicated transport channels

The Dedicated Channel (DCH) is an uplink or downlink transport channel that is used to carry user or control information between the network and a UE.

Two types of dedicated transport channels have been identified:

1. Dedicated Channel (DCH) characterized by:
    - existence in uplink or downlink,
    - possibility to use beamforming,
    - possibility to use uplink synchronization (uplink only),
    - possibility to change rate fast,
    - closed loop power control (uplink only),
    - inherent addressing of UEs.
2. ODMA Dedicated Transport Channel (ODCH) characterized by:
    - possibility to change rate fast
    - closed loop power control,
    - closed loop timing advance control,
    - temporary addressing of UEs.

[Editors Note: ODMA in TD-SCDMA is under study.]

4.1.2 Common transport channels

Common transport channels are:

1. Broadcast Channel (BCH) characterized by:
    - existence in downlink only,
    - low fixed bit rate,
    - requirement to be broadcast in the entire coverage area of the cell.

The Broadcast Channel (BCH) is a downlink transport channel that is used to broadcast system- and cell-specific information.

2. Paging Channel (PCH) characterised by:
    - existence in downlink only,
    - possibility for sleep mode procedures,
    - requirement to be broadcast in the entire coverage area of the cell.

The Paging Channel (PCH) is a downlink transport channel that is used to carry control information to a UE when the system does not know the location cell of the UE.

3. Forward Access Channel(s) (FACH) characterized by:
    - existence in downlink only,
    - possibility to use beamforming,
    - possibility to use power control,
    - possibility to change rate fast (each 5ms),
    - requirement for in-band identification of UEs.

The Forward Access Channel (FACH) is a downlink transport channel that is used to carry control information to a UE when the system knows the location cell of the UE. The FACH may also carry short user packets.

4. Random Access Channel(s) (RACH) characterized by:
    - existence in uplink only,
    - possibility to use beamforming,
    - limited data field. The exact number of allowed bits is FFS,
    - collision risk,
    - possibility to use open loop and closed loop uplink synchronization,
    - open loop and closed loop power control,
    - requirement for in-band identification of the UEs.

The Random Access Channel (RACH) is a reverse link transport channel that is used to carry control information from UE. The RACH may also carry short user packets.

5. ODMA Random Access Channel (ORACH) characterized by:
    - existence in relay links,
    - collision risk,
    - open loop power control,
    - no timing advance control,
    - requirement for in-band identification of the UEs.

[Editors Note: ORACH in TD-SCDMA is under study.]

6. Synchronization Channel (SCH) characterized by:
    - existence in downlink and uplink,
    - possibility to use beamforming,
    - low fixed bit rate,
    - requirement to be broadcast in the entire coverage area of the cell (downlink only).

7. Uplink shared Channel (USCH)

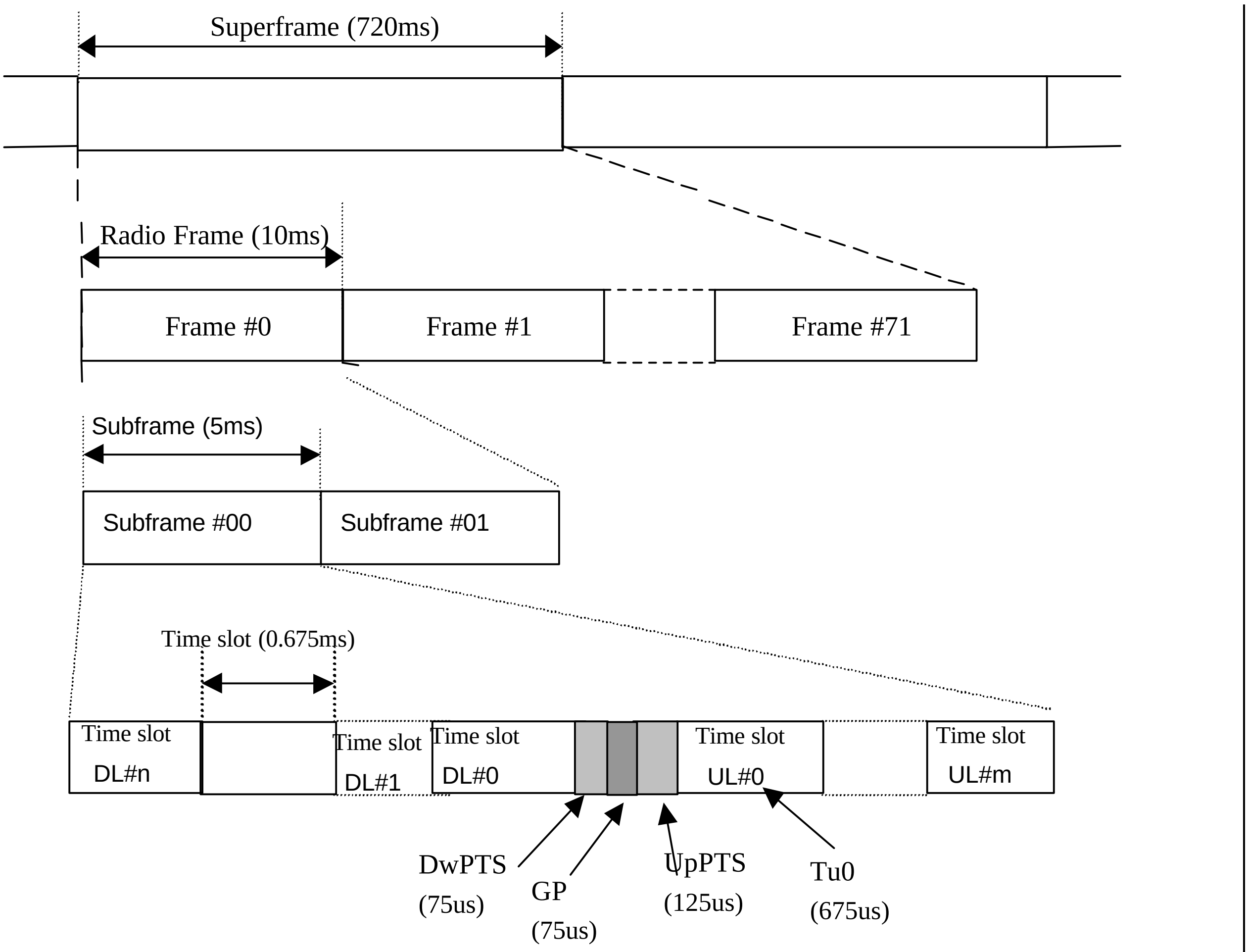
[editor: need some contents]

8. Downlink shared Channel (DSCH)

[editor: need some contents]

5 Physical channels

All physical channels take four-layer structure of superframes, radio frames, subframes and time slots/codes. Depending on the resource allocation, the configuration of subframes or time slots becomes different. All physical channels need guard symbols in every time slot. The time slots/codes are used in the sense of a TDMA component to separate different user signals in the time and the code domain. The physical channel signal format is presented in Figure 1.
The basic physical channel is defined as the association of one code, one time slot and one frequency.



where n+m+2=7

Figure 1. Physical channel signal format

5.1 Frame structure

5.1.1 Genereal description

The radio frame has a duration of 10 ms and is subdivided into 2 subframes of 5ms each, and each subframe is then subdivided into 7 main time slots (TS) of 675 µs duration each and 3 special time slots: DwPTS (downlink pilot), GP (guard period) and UpPTS (uplink pilot). The physical contents of the time slots are the bursts of corresponding length as described in section 5.2.2.

Among the 7 main time slots, for the uplink and the downlink are separated by single switching point, all the main time slots (at least one main time slot) before the single switching point are allocated as downlink, and all the main time slots (at least one main time slot) behind the single switching point are allocated as uplink (Figure 2). With such flexibility, the TDD mode can be adapted to different environments and deployment scenarios.

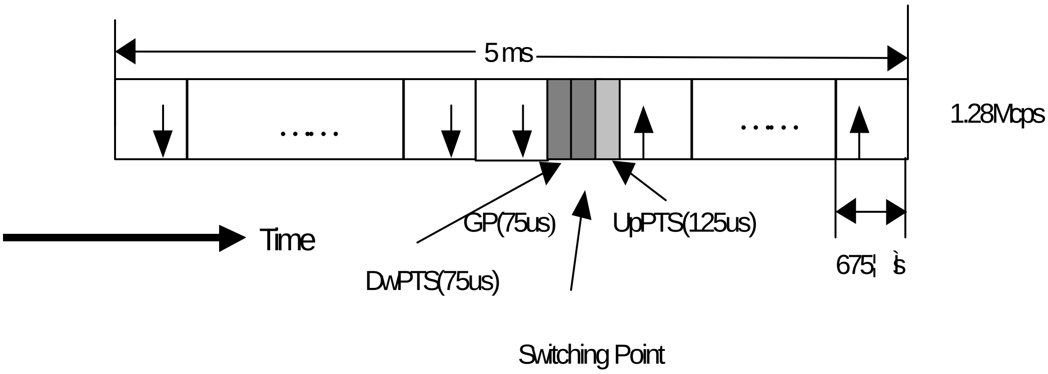
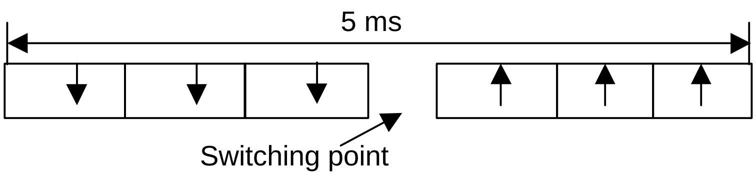
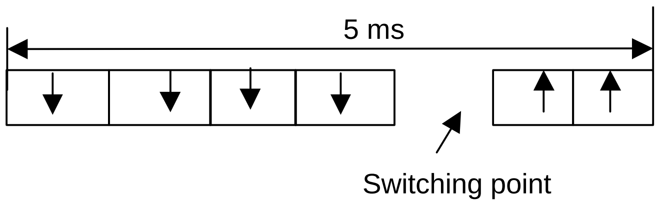


Figure 2. The TDD subframe structure

Examples for symmetric and asymmetric UL/DL allocations are given in Figure 3.



Symmetric DL/UL allocation



Asymmetric DL/UL allocation

Figure 3. TDD subframe structure examples

5.1.2 Special time slot for synchronization

5.1.2.1 Downlink Pilot Time Slot (DwPTS)

The DwPTS(SYNC) in each subframe is designed for both downlink pilot and SCH. The Node B would transmit it omnidirectionally or sectorially at the full power level without beamforming. This time slot is usually composed of 64 chips of SYNC and 32 chips of guard period as shown in Figure 4 . The contents in the SYNC are a set of Gold code as defined in Table 1. The Gold code set is designed to distinguish nearby cells for the purpose of easier cell measurement. The set of code could be repeated in the cellular network.

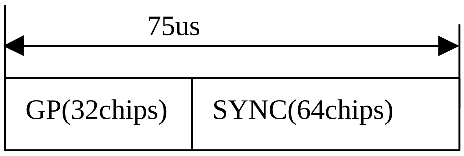


Figure 4 . Burst structure of DwPTS

Table 1. The Gold code sequences of SYNC for downlink pilot

No.	Code sequences
1	8388B0638AE3FE7B
2	C7A4195F917B158D
3	9EF66168A0ACF89D
4	CC8E56597741E82F
5	312C400DE94C245B
6	1B6346EBD3B1864D
7	8E44C598CECF5747
8	CA686CA4D557BCB1
9	E6C150BF4DBC4A39
10	FBBF81B467F34CDF
11	856E8A9E28F5AAE5
12	DADAC854BB34136B
13	6E9802C77A8D9DD5
14	B4B9678E9A515A8B
15	59A9D52A6A3F3925
16	AF218C78120808F3
17	5465A0D12E139019
18	D716BDAFFF18BA57
19	687E383AD89BC94B
20	37CA7AF04B5A70C5
21	98105B9502BAAC03
22	A40BC37EF432F551
23	D1F087525D0EEEC9
24	BF9328887C6BA729
25	DC3CF2A9192247F5
26	EDEB1FB9AB86B79B
27	7500E931F2D4CFAD
28	B9751275DE7DF3B7
29	5F4FEFD7C8296DBB
30	2C529106C30322BD

5.1.2.2 Uplink Pilot Time Slot (UpPTS)

The UpPTS in each subframe is designed for both uplink pilot and SCH. When a UE is in the status of air-registration and random access, it would transmit UpPTS followed by RACH. The time slot is usually composed of 128chips of SYNC1 and 32chips of GP as shown in Figure 5. The contents in the SYNC1 is a set of Gold code as defined in Table 2. The Gold code set is designed to distinguish different UEs in access procedures.

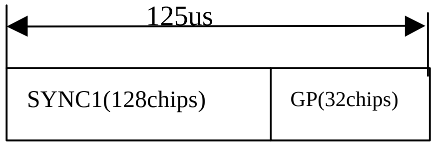


Figure 5 . Burst structure of UpPTS

Table 2. The Gold code sequences of SYNC1 for uplink pilot in UpPTS

No.	Code sequences
1	FE3B14BEA85BCE5660DAE8C881269EE1
2	FEEDE8B2F8819B1CEB84C156929E46A1
3	003F0CEF4C021AAC7C935D750C0878B5
4	813918965A77242B6EFE321647B1EDCB
5	41BA12AAD14DBB68E7C885A7E26D2775
6	A1FB97B494D0F4C92353DE7F3083422B
7	51DB553BB61E5319C11E739359F47085
8	A9CB347C277900F1B038A5656D4FE9D3
9	55C304DFEFCAA90588ABCE1E77122579
10	ABC71C8E0B937DFF94E27BA3FA3CC32D
11	D4C510A6F9BF97829AC6A17D3CABB007
12	6B4416B280A9E2BC1DD4CC125FE00993
13	348495B8BC22D8235E5DFAA5EE45D559
14	9B64D43DA267456CFF9961FE36973B3D
15	CC94F4FF2D458BCB2F7B2C53DAFE4C0F
16	676CE49E6AD4EC98C70A0A852CCAF797
17	3290ECAEC91C5F31333299EE57D0AA5B
18	186EE8B698F806E5C92ED05BEA5D84BD
19	8D11EABAB00A2A0FB420F481349B13CF
20	47AE6BBCA4733C7A8AA7E6EC5BF85877
21	22F1AB3FAE4FB74015E46FDAEC49FDAB
22	105E4B7E2B51F2DD5A45AB41B7912F45
23	8909BB5EE9DED013FD95490C1A7D4633
24	45A2434E88994174AE7D382ACC8B7289
25	A3F7BF46B83A89C7078900B9A7F068D5
26	D0DD4142A06B6D9ED3731CF0124DE5FB
27	69483E40AC439FB2390E12D4C893236D
28	B58281C1AA57E6A44C3095C6A5FC4027
29	5BE7DE01295DDA2F76AFD64F934BF183
30	2CD571E168D8C46AEBE0778B08102951
31	974C2611481A4B482547A76945BDC539
32	CA808DE9587B0CD942144F18636B330D
33	E466D815504BAF11F1BDBB20F0004817
34	7315F2EB5453FEF5A869413CB9B5F59B
35	38AC6794565FD60784833C329D6F2B5D
36	9D70AD2BD759C27E92F602B58F02443F
37	4F9EC87417DAC84219CC9DF60634F38F
38	26E9FADBF79B4D5C5C51D257C2AFA857
39	1252638C07BB8FD37E9F758720E205BB

40	080FAF27FFABEE94EFF8266F51C4D34D
41	8521497203A3DE37274B8F9B6957B837
42	43B63A58FDA7C666C3125B61751E0D8B
43	20FD83CD82A5CA4E313EB11C7B3AD755
44	91585F073D24CC5A4828C422FC28BA3B
45	498AB16262E44F5074A3FEBDBFA18C8D
46	A5E3C650CD040ED56AE663F21E6517D7
47	53D77DC99AF42E17E5C4AD55CE875A7B
48	28CD2005310C3E76A255CA0626F67CAD
49	95400EE364F03646019D79AFD2CEEFC7
50	4B8699904E0E325E5079207B28D2A673
51	24E5D229DB713052788B0C9155DC82A9
52	935477F511CEB1546CF21AE46B5B90C5
53	C88CA51B749171D766CE91DEF41819F3
54	6560CC6C463E9196E3D0D443BBB9DD69
55	B396F8D7DF6961B6215FF68D1C693F25
56	D8EDE28A13C299A6401867EA4F814E03
57	6D506FA4F59765AE70BBAF59E6757691
58	B78EA93386BD9BAA68EA4B00328F6AD9
59	DAE1CA783F28E4A864C2B92CD8F264FD
60	EC567BDDE3E25B2962D6C03AADCCE3EF
61	770DA30F0D8704E9E1DCFCB19753A067
62	3AA04F667AB5AB09A059E2F40A1C01A3
63	1C76B952C12CFCF9809B6DD6C4BBD141
64	8F1DC2489CE0570190FA2A47A3E83931
65	C6A87FC5B20602FD98CA898F1041CD09
66	E272A103257528039CD2D86B49953715
67	F01FCE606ECCBD7C9EDEF099657F4A1B
68	792979D1CB1077C31FD8E4E0730A749D
69	BDB2220919FE129CDF5BEEDCF830EBDF
70	5FFF8FE5708920333F1A6BC2BDADA47F
71	2ED959134432B964CF3AA94D9F6303AF
72	164A32685E6F75CF372AC80A0E045047
73	0A0387D5D341939ACB22F8A9C6B7F9B3
74	04275D0B15D6E0B03526E0F822EE2D49
75	83353064769D59254A24ECD0D0C2C735
76	C0BC06D3C73885EFF5A5EAC4A9D4B20B
77	61789D881FEA6B8AAA6569CE955F8895
78	B19AD025F3831CB80585284B8B1A15DB
79	59EBF6F305B7A721527508890438DB7D
80	ADD365987EADFAEDF98D18E843A9BC2F
81	57CF2C2DC320D40BAC7110D8E0610F87
82	2AC108F71DE64378868F14C0B1855653
83	14461A9A728508C113F016CC99777AB9
84	8B0593ACC534AD1DD94F97CA8D0E6CCD
85	C4A457379EEC7FF3BC1057498732E7F7
86	6374B57A330016848EBFB708022CA26B
87	309CC45CE5F6223F17E84728C0A380A5
88	9968FCCF8E8D3862DB43BF38A1E411C3
89	4D92E0863B30B54C3D1643309147D971
90	A7EFEEA2E1EE73DB4E3CBD3489163D29
91	D2D169B08C811090F7A9C236853ECF05
92	E84E2A39BA36A1352B637DB7832AB613
93	75018BFD216D79E7C506227700208A99
94	BBA65B1F6CC0958EB2348D9741A594DD
95	DCF5B36E4A1663BA09ADDA6761671BFF

96	6F5C4756D97D18A05461719F71065C6F
97	3688BD4A90C8A52D7A8724637936FFA7
98	1A62C044B4127BEBEDF40E9D7D2EAE43
99	0C17FEC3A67F1488A64D9BE27F2286B1
100	872D61802F49A3390391515DFE2492C9
101	C2B02E21EBD2F8E1D17F34023EA798F5
102	E07E89F1099F550DB80806ADDEE61DEB
103	7119DA1978B983FB8CB39FFA2EC6DF65
104	B9AA73ED402AE88096EE5351D6D6BE23
105	5DF3A7175C635D3D1BC0B5042ADE8E81
106	AFDF4D6A524787E3DD57C62ED4DA96D1
107	D6C93854D555EA8CBE1C7FBBABD89AF9
108	EA4202CB96DCDC3B0FB9A37114599CED
109	F4079F8437184760D76B4D144B991FE7
110	7B255123E7FA0ACD3B023A26E4795E63
111	3CB436700F8B2C1BCD3681BFB3897EA1
112	9F7C85D9FBB3BF70B62CDC7318716EC1
113	CE98DC0D01AFF6C50BA1F2954D8D66F1
114	E66AF0E77CA1D21FD56765E6677362E9
115	F213E6924226C072BA042E5FF20C60E5
116	F82F6DA8DD6549440DB58B8338B3E1E3
117	7D31283592C48DDF566D596D5DEC2161
118	BFBE0AFB35146F92FB81301A6F43C121
119	DEF99B9C66FC1EB42D7704A1F6143101
120	EE5A532FCF082627460C1EFC3ABFC911
121	F60BB7761BF23A6EF3B193D2DCEA3519
122	FA23455AF18F344A296F5545AFC0CB1D
123	FC373C4C84B1B3584400360E1655B41F
124	7F3D00C7BE2EF0D172B787ABCA9F0B9F
125	3EB81E8223615115E9EC5F7924FA545F
126	1E7A91A0EDC681F7A441B31053C8FBBF
127	0E1BD6318A95698682974524E851AC4F
128	062B75F9393C9DBE11FC3E3EB59D07B7
129	0233241D60E867A2584983B39B7B524B

5.1.2.3 Guard Period (GP)

The guard period in switching point of Tx to Rx for Node B has the duration of 75us (96 chips).

5.2 Dedicated physical channel (DPCH)

The DCH are mapped onto the dedicated physical channel.

5.2.1 Spreading codes

Two options are being considered for the bursts that can be sent as described below. Both options allow a high degree of bit rate granularity and flexibility, thus allowing the implementation of the whole service range from low to high bit rate.

Spreading factor of and the number of codes for multicode transmission are assigned independently for uplink and downlink. The number of time slots is also assigned independently for uplink and downlink.

5.2.1.1 Multicode transmission with fixed spreading

Within each time slot of length 675 µs, an additional separation of user signals by spreading codes is used. This means, that within one time slot of length 675 µs, more than one burst of corresponding length as described in section 5.2.2 can be transmitted. These multiple bursts within the same time slot can be allocated to different users as well as partly or all to a single user. For the multiple bursts within the same time slot, different spreading codes are used to allow the distinction of the multiple bursts.

The bursts as described in section 5.2.2 are designed in such a way, that up to 16 users' bursts can be transmitted within one time slot, if the bursts are allocated to different users in the uplink.

5.2.1.2 Single code transmission with variable spreading

Within each time slot of length 675 us, a UE always uses single code transmission by adapting the spreading factor as a function of data rate. This limits the peak-to-average ratio of the modulated signal, and consequently the stress imposed to the power amplifier results in an improved terminal autonomy. Several UEs can be received by the base station in the same time slot, they are separated by their codes and the individual decoding can take profit of the joint detection.

5.2.2 Burst Types

As explained in the section 5.2.1, two options are being considered for the spreading. The bursts described in this section can be used for both options.
The burst type 1 consist of two data symbol fields, a midamble of 144 chips and a guard period of 16 chips. The data fields of the burst type 1 are 704chips long. The corresponding number of symbols depends on the spreading factor as indicated in Table 3 below. The guard period for the burst type 1 is 16 chips period long.

The bursts type 1 is shown in Figure 6. The contents of the burst fields are described in Table 4.

Table 3. Number of symbols per data field in bursts 1

Spreading factor (Q)	**Number of symbols (N) per data field in Burst 1**
1	352
2	176
4	88
8	44
16	22

Table 4. The contents of the burst type 1 fields

Chip number (CN)	**Length of field in chips**	**Length of field in symbols**	**Length of field in µs**	**Contents of field**
0-351	352	cf Table 3	275	Data symbols
352-495	144	9	112.5	Midamble
496-847	352	cf Table 3	275	Data symbols
848-863	16	1	12.5	Guard period

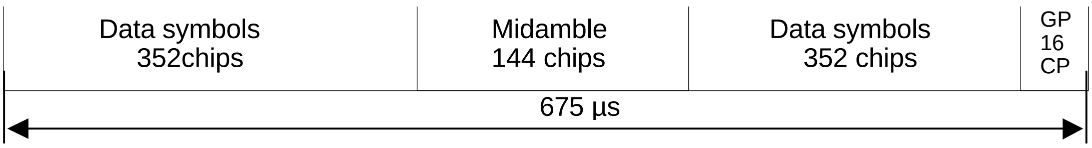


Figure 6 . Burst structure of the burst type 1.

(GP denotes the guard period and CP the chip period.)

5.2.2.1 Transmission of L1 Control Signals

The burst type 1 for dedicated channels provide the possibility for transmission of L1 control signals in uplink and downlink respectively.

The transmission of L1 control signals is necessary in all communication procedures. As an example, this section show the L1 control symbols of burst type 1 except in FACH and RACH which more symbols are required for L1 control signals. Hence the midamble structure and length is not changed. The L1 control signals are to be transmitted directly adjacent to the midamble, Figure 7 shows an example of the position of the L1 control signals in traffic burst.

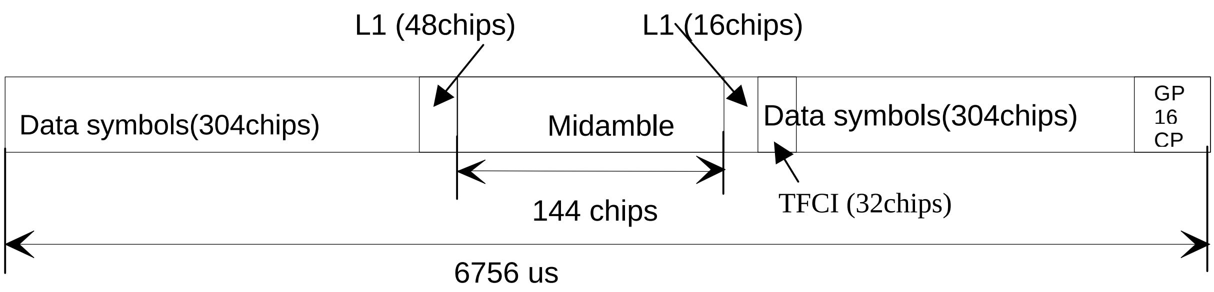


Figure 7. Position of L1 control signals in the traffic burst,

(GP denotes the guard period and CP the chip period)

The L1 control signals are spread with the same spreading factor (SF) as the data parts. The SF of the burst which contains the L1 control signal is applied to both data and signalling and shall be constant, except when a negotiation between transmitter and receiver initiates a change of the SF.

Note: In Figure 7, The L1 control signals content 4 symbols, they are:

Power Control (PC)	1 symbol
Timing Advance (SS)	1 symbol
Stealing Flag (SF)	1 symbol
CRC	1 symbol

5.2.3 Training sequences for spread bursts

The training sequences, i.e. midamble, of different users active in the same time slot are time-shifted versions of one single periodic basic code. Different cells use different periodic basic codes, i.e. different midamble sets. In this way joint channel estimation for the channel impulse responses of all active users within one time slot can be done by one single cyclic correlation. The different user specific channel impulse response estimations are obtained sequentially in time at the output of the correlator. Following this principle it is shown hereafter how to derive the midamble from the periodic basic code.

Section 5.2.2 contains a description of the spread speech/data bursts. These bursts contain Lm midamble chips, which are also termed midamble elements. The Lm elements $\underline{m}_i^{(k)}$; i=1...Lm; k=1,...,K; of the midamble codes $\underline{\mathbf{m}}^{(k)}$; k=1,...,K; of the K users are taken from the complex set

$$\underline{\mathrm{V}}_{\mathrm{m}} = \{1, \mathrm{j}, -1, -\mathrm{j}\}. \qquad (1)$$

The elements $\underline{m}_i^{(k)}$ of the complex midamble codes $\underline{\mathbf{m}}^{(k)}$ fulfil the relation

$$\underline{m}_i^{(k)} = (\mathrm{j})^i \cdot m_i^{(k)} \quad m_i^{(k)} \in \{1, -1\}; i = 1,\ldots,L_m; k = 1,\ldots,K. \qquad (2)$$

Hence, the elements $\underline{m}_i^{(k)}$ of the complex midamble codes $\underline{\mathbf{m}}^{(k)}$ of the K users are alternating real and imaginary.

With W being the number of taps of the impulse response of the UE radio channels, the Lm binary elements $m_i^{(k)}; \mathrm{i}=1,...,L_\mathrm{m}; k=1,...,K;$ of (2) for the complex midamble $\underline{\mathbf{m}}^{(k)}$; k=1,...,K; of the K users are generated according to Steiner's method [1] from a single periodic basic code

$$\mathbf{m} = \left(m_1, m_2, ..., m_{L_m+(K-1)W}\right)^\mathrm{T} \ m_i \in \{1,-1\}; \ i=1,...,(L_m+(K-1)W). \qquad (3)$$

The elements $m_i; i=1,...,(L_m+(K-1)W),$ of (3) fulfil the relation

$$m_i = m_{i-P} \text{ for the subset } i=(P+1),...,(L_m+(K-1)W). \qquad (4)$$

The P elements $m_i; i=1,...,P,$ of one period of m according to (3) are contained in the vector

$$\mathbf{m}_\mathrm{P} = (m_1, m_2, ..., m_P)^\mathrm{T}. \qquad (5)$$

With $\mathbf{m}$ according to (3) the Lm binary elements $m_i^{(k)}; \mathrm{i}=1,...,\mathrm{L}_\mathrm{m}; k=1,...,K;$ of (2) for the midamble of the K users are generated based on Steiner's formula

$$m_i^{(k)} = m_{i+(K-k)W} \quad i=1,...,L_m; k=1,...,K. \qquad (6)$$

In the following the term 'a midamble code set' or 'a midamble code family' denotes K specific midamble codes $\underline{\mathbf{m}}^{(k)}$; k=1,...,K. Different midamble code sets $\underline{\mathbf{m}}^{(k)}$; k=1,...,K; are in the following specified based on different periods $\mathbf{m}_\mathrm{P}$ according (5).

In adjacent cells of the cellular UE radio system, different midamble codes sets $\underline{\mathbf{m}}^{(k)}$; k=1,...,K; should be used to guarantee a proper channel estimation.

As mentioned above a single midamble code set $\underline{\mathbf{m}}^{(k)}$; k=1,...,K; consisting of K midamble codes is based on a single period $\mathbf{m}_\mathrm{P}$ according to (5).

In the following several exemplary periods $\mathbf{m}_\mathrm{P}$ according (5) which can be used to generate different midamble code sets $\underline{\mathbf{m}}^{(k)}$; k=1,...,K; will be listed in tables in a hexadecimal representation. As shown in Table 5 always 4 binary elements m_i are mapped on a single hexadecimal digit.

Table 5. Mapping of 4 binary elements m_i on a single hexadecimal digit

4 binary elements m_i	mapped on hexadecimal digit
-1 -1 -1 -1	0
-1 -1 -1 1	1
-1 -1 1 –1	2
-1 -1 1 1	3
-1 1 -1 –1	4
-1 1 -1 1	5
-1 1 1 –1	6
-1 1 1 1	7
1 -1 -1 –1	8
1 -1 -1 1	9
1 -1 1 –1	A
1 -1 1 1	B
1 1 -1 –1	C
1 1 -1 1	D
1 1 1 –1	E
1 1 1 1	F

The mean degradation's [2, equation (38)] which serve as a quality information of the periods $\mathbf{m}_\mathrm{P}$ according to (5) and hence of the specified midamble code sets $\underline{\mathbf{m}}^{(k)}$; k=1,...,K; will be also given.

5.2.3.1 Midamble Transmit Power

In principle, the midamble transmit power would be the same as the data symbols in the same burst.

5.3 Common control physical channels (CCPCH)

5.3.1 Downlink common control physical channel

The BCH, the PCH or the FACH as described in section 4.1.2 are mapped onto one or more downlink common control physical channels (CCPCH). In such a way the capacity of BCH, PCH and FACH can be adopted depending on the operator's requirement.

5.3.1.1 Spreading codes

The downlink CCPCH uses fixed spreading with a spreading factor SF = 16 as described in section 5.2.1.1.

5.3.1.2 Burst Types

The bursts type 1 as described in section 5.2.2 are used for the downlink CCPCH.

5.3.1.3 Training sequences for spread bursts

The training sequences, i.e. midamble, as described in section 5.2.3 are used for the downlink CCPCH.

5.3.2 The physical random access channel (PRACH)

The RACH as described in section 4.1.2 are mapped onto one or more uplink physical random access channels (PRACH). In such a way the capacity of RACH can be adopted depending on the operator's requirement.

5.3.2.1 Spreading codes

The uplink PRACH uses fixed spreading with a spreading factor SF = 16 as described in section 5.2.1.1.

5.3.2.2 Burst Types

The UEs send the uplink access bursts randomly in the uplink PRACH. This leads to collision groups. The usage of maximum 8 orthogonal spreading codes in the first main uplink time slot increases the amount of collision groups and throughput, respectively.

A further improvement is achieved by using a set of Gold codes in the UpPTS time slot. Because the PRACH is only located in the first main uplink time slot, which can transmit more than one RACH within one time slot without collision. When a UE attempts to send the uplink access burst, it would simultaneously choose any one spreading code in the first main uplink time slot and any one Gold code in the UpPTS time slot by random. The possibility of collision would be very low because of the orthogonal performance of the two sets of codes.

Although the maximum 8-pair orthogonal codes may be available by design, the actual working number of the codes would be decided by operator.

5.3.2.3 Training sequences for access bursts

The training sequences, i.e. midamble, as described in section 5.2.3 are used for the uplink PRACH.

5.4 The physical synchronization channel (PSCH)

As described in section 5.1.2, the PSCH is located that:

The downlink PSCH is located in DwPTS as shown in Figure 4,

The uplink PSCH is located in UpPTS as shown in Figure5,

6 Mapping of transport channels to physical channels

This section describes the way, in which transport channels are mapped onto physical resources

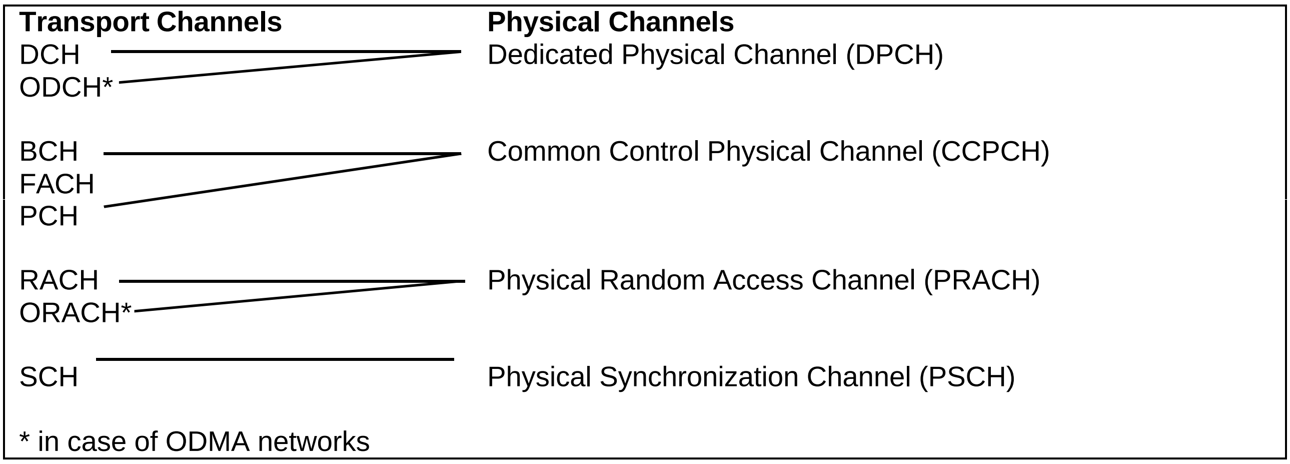


Figure 8 Transport channel to physical channel mapping

In the sequel, we use the term's physical channel and resource unit (RU), a physical channel is defined as the association of one code, one time slot and one frequency. A resource unit (RU) is that part of a physical channel allocated for one subframe.

6.1 Dedicated Transport Channels

A dedicated transport channel is mapped onto one or more sets of time slots and codes within a subframe. An interleaving period is associated with each allocation. The subframe is subdivided into time slots/codes that are available for uplink and downlink information transfer. Each set of time slots and codes over an interleaving period maps to a data unit and a data unit can correspond to one or more FEC code blocks and one or more RLC protocol data units dependent from the service being supported. The mapping is illustrated by the following diagram (Figure 9):

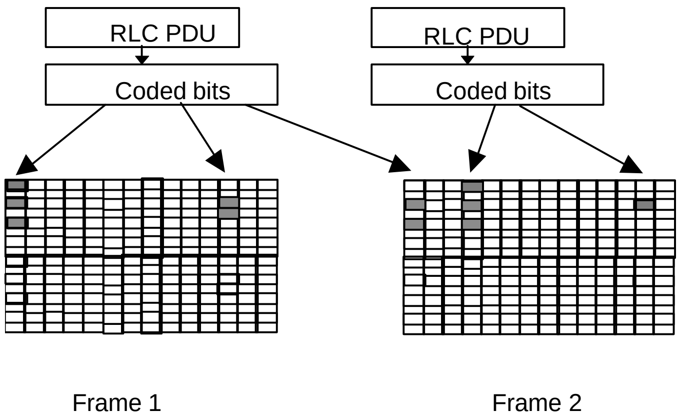


Figure 9. Mapping of PDU onto the physical bearer

For NRT packet data services an allocation is made only for a relatively short period of time. In general, for

RT services an allocation is made for a certain time period and a release procedure is necessary to release the resource. For the efficient use of resources the time slot/ code set allocated to a radio bearer may be changed from time to time and the resources allocated to a VBR service may increase or decrease along with the changes in the data rate. Traffic channels are power controlled.

6.2 Common Transport Channels

6.2.1 The Broadcast Channel (BCH)

The BCH is mapped on one RU in the first downlink time slot per subframe. The BCH has higher transmission power level (9-11dB higher than average power level in one RU) with omnidirectional or sectorial pattern (without beamforming). The RU allocated for BCH would be shared with other common control channels: PCH, according to a superframe structure.

6.2.2 The Paging Channel (PCH)

The PCH would be mapped onto the same location as BCH. The PCH is always transmitted with the same power level and antenna pattern as those of the BCH.

6.2.3 The Forward Access Channel (FACH)

The FACH can be mapped onto more than one (up to 8) RU in the first downlink time slot per subframe. The location of the FACH is indicated on the BCH. FACH may or may not be power controlled. FACH has average transmission power lever and its radiation pattern is beam formed.

6.2.4 The Random Access Channel (RACH)

The RACH is mapped onto more than one (up to 8) RU in the first uplink time slot per subframe. The same time slot may be used for RACH by more than one cell. Multiple transmissions using different codes could be received in parallel. The location allocated to RACH in the time slots is indicated on the BCH. The RACH uses both power control and uplink synchronisation control.

6.2.5 The Synchronization Channel (SCH)

The SCH is mapped onto the PSCH as described in section 5.4.

6.3 Multiframe structure

A strong requirement for the multiframe structure comes from the realization of low cost dual-mode FDD-TDD terminals and from the GSM compatibility of the UTRA proposal. In this respect the superframe and multiframe structure for TDD and FDD mode have to be compatible and harmonised with GSM.
Thus in the proposed structure a superframe is composed of 72 radio frames each of length 10 ms. So the superframe period is 720 ms.
All frames in the traffic channel multiframes are used to carry both user data and dedicated signalling. The TDD superframe matches exactly a FDD multiframe ensuring the compatibility of both modes.

History

Document history		
V0.1.0	1999-04	Document created based on the documents CATT TD-SCDMA RTT V 0.5
V1.0.0	1999-05-12	Document updated based on the 3GPP S1.21 V2.0.0 and the discussion between Siemens and CATT. This draft has been discussed in the CWTS WG1 Ad Hoc1#1 meeting, Beijing, May 12th, 1999.
V1.1.0	1999-05-21	Document updated based on the CWTS WG1#3 meeting, Beijing, May 21st, 1999.
V1.2.0	1999-07-21	Revised after discussion
V1.3.0	1999-08-05	Revised after discussion in CWTS#2 meeting in Aug5-7,1999
V2.0.0	1999-08-30	Revised in CWTS#3 meeting in Aug 29-30, 1999
V2.0.1	1999-09-16	Text modification only
V2.1.0	1999-10-2	Chip rate changed to 1.28Mcps

Editor for C102, Physical channels and mapping of transport channels onto physical channels (TD-SCDMA), is:

Mr. Guiliang Yang

CATT

Email: yanggl@pub.tdscdma.com

This document is written in Microsoft Word 97.