TSG-RAN WORKING GROUP 1 MEETING NO. 17 *TSGR1-00-1003*

STOCKHOLM, SWEDEN, 21-24 NOV. 2000

Agenda Item:	AH99
Source:	Siemens AG
Title:	Correction on TFCI & TPC Transmission
Document for:	Approval

1 INTRODUCTION

The current specification TS25.221 fixes the SF for the TFCI carrying codes. The intention to fix the SF for the TFCI carrying code is to enable TFCI detection before detecting the remaining physical channels with unknown SF. The SF of these channels is given by the TFCI.

The minimum SF is allocated to cover the highest possible bit rates. In case of lower bit rates the UE will apply repetition in order to fill the allocated bits and will reduce the Tx power at the same time according to the gain factors as defined in TS25.224. However, repetition is not applied to the TFCI & TPC field, so the reliability of the TFCI and TPC will decrease due to the reduced power.

2 PROPOSAL

In order to maintain the reliability of the TFCI/TPC, it is proposed to fix the SF to 16 for the TFCI and TPC field in the UL physical channels. Moreover, the autonomous change of the SF in the UE is proposed to be an option that can be set by the network. This will enable NodeB implementations that do not include the possibility of SF detection, allowing a trade-off between performance & complexity in implementation.

Corresponding CRs for TS25.221 and TS25.222 can be found in this TDoc.

3GPP TSG RAN WG1 Meeting #17
Stockholm, Sweden, 21-24 November 2000

Document R1-001003
e.g. for 3GPP use the format TP-99xxx
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25.221 CR 034 Current Version: 3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: RAN#10
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for approval	X	strategic	
for information		non-strategic	

(for SMG use only)

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: Siemens AG **Date:** 2000-10-29

Subject: Correction on TFCI & TPC Transmission

Work item:

Category:
(only one category shall be marked with an X)

F	Correction	X	
A	Corresponds to a correction in an earlier release		
B	Addition of feature		
C	Functional modification of feature		
D	Editorial modification		

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: Fixes the SF for the TFCI and TPC field to 16 in order to enable high repetition factors on the data field in case of low bit rates and low fixed SF.

Clauses affected: 5.2.1.2, 5.2.2.1, 5.2.2.2, 5.2.2.3

Other specs affected:

Other 3G core specifications		→ List of CRs:	CR222-050
Other GSM core specifications		→ List of CRs:	
MS test specifications		→ List of CRs:	
BSS test specifications		→ List of CRs:	
O&M specifications		→ List of CRs:	

Other comments:

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5.2.1.2 Spreading for Uplink Physical Channels

The range of spreading factor that may be used for uplink physical channels shall range from 16 down to 1. For each physical channel an individual minimum spreading factor SF_{min} is transmitted by means of the higher layers. There are two options that are indicated by UTRAN:

1. The UE shall use the spreading factor SF_{min}, independent of the current TFC.

2. The UE shall autonomously increase the spreading factor depending on the current TFC.

If the UE autonomously changes the SF, it shall always vary the channelisation code along the lower branch of the allowed OVSF sub tree, as depicted in [8].

For multicode transmission a UE shall use a maximum of two physical channels per timeslot simultaneously. These two parallel physical channels shall be transmitted using different channelisation codes, see [8].

5.2.2.1 Transmission of TFCI

All burst types 1, 2 and 3 provide the possibility for transmission of TFCI.

The transmission of TFCI is negotiated at call setup and can be re-negotiated during the call. For each CCTrCH it is indicated by higher layer signalling, which TFCI format is applied. Additionally for each allocated timeslot it is signalled individually whether that timeslot carries the TFCI or not. If a time slot contains the TFCI, then it is always transmitted using the first allocated channelisation code in the timeslot, according to the order in the higher layer allocation message.

The transmission of TFCI is done in the data parts of the respective physical channel. Independent of the SF that is applied to the data symbols in the burst, the data in the TFCI field are always spread with SF=16 using the channelisation code in the lowest branch of the allowed OVSF sub tree, this means TFCI and data bits are subject to the same spreading procedure as depicted in [8]. Hence the midamble structure and length is not changed. The TFCI information is to be transmitted directly adjacent to the midamble, possibly after the TPC. Figure 6 shows the position of the TFCI in a traffic burst in downlink. Figure 7 shows the position of the TFCI in a traffic burst in uplink.

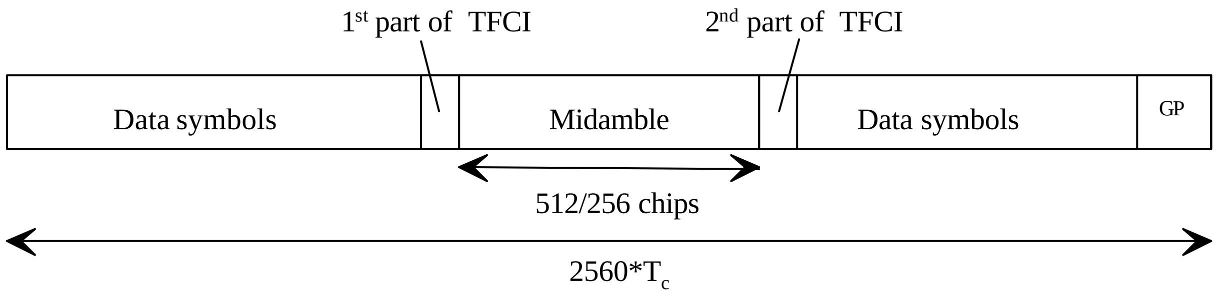

Figure 7: Position of TFCI information in the traffic burst in case of downlink

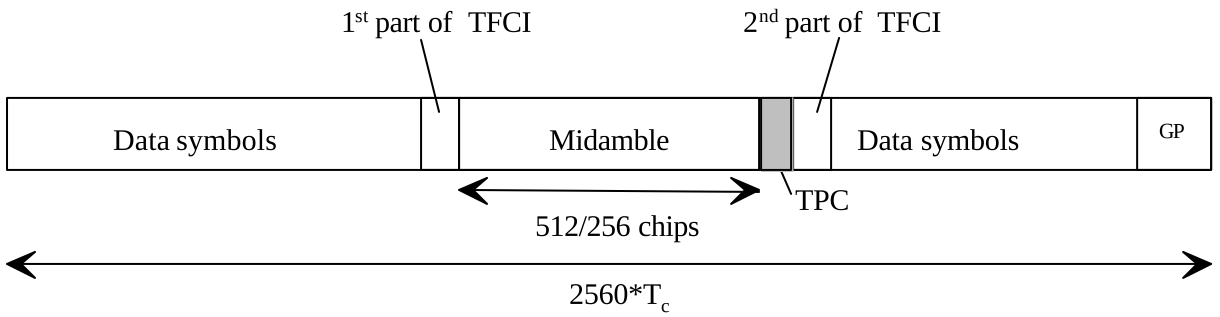

Figure 8: Position of TFCI information in the traffic burst in case of uplink

Two examples of TFCI transmission in the case of multiple DPCHs used for a connection are given in the Figure 8 and Figure 9 below. Combinations of the two schemes shown are also applicable. It should be noted that the SF can vary for the DPCHs not carrying TFCI information.

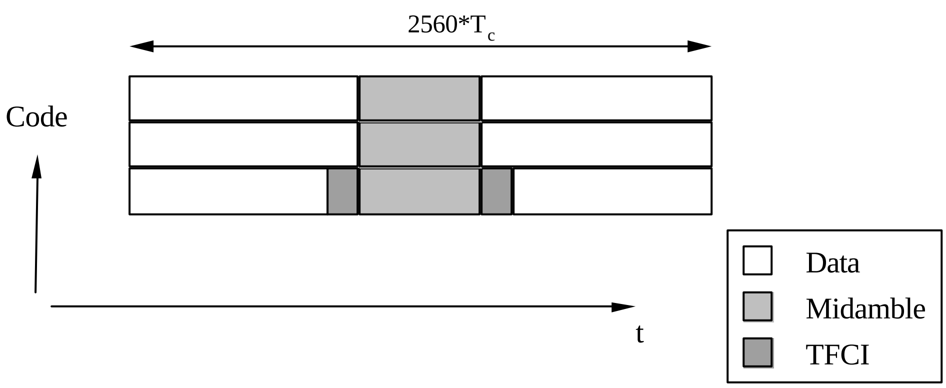

Figure 9: Example of TFCI transmission with physical channels multiplexed in code domain

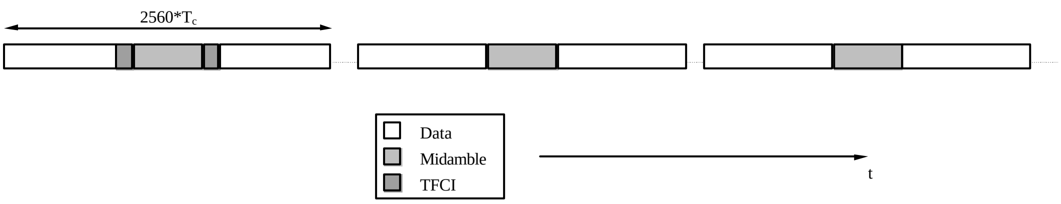

Figure 10: Example of TFCI transmission with physical channels multiplexed in time domain

5.2.2.2 Transmission of TPC

All burst types 1, 2 and 3 for dedicated channels provide the possibility for transmission of TPC in uplink.

The transmission of TPC is done in the data parts of the traffic burst. Independent of the SF that is applied to the data symbols in the burst, the data in the TPC field are always spread with SF=16 using the channelisation code in the lowest branch of the allowed OVSF sub tree, as depicted in [8]. Hence the midamble structure and length is not changed. The TPC information is to be transmitted directly after the midamble. Figure 10 shows the position of the TPC in a traffic burst.

For every user the TPC information shall be transmitted at least once per transmitted frame. If TFCI is applied for a CCTrCH, TPC shall be transmitted with the same channelization codes and in the same timeslots as TFCI. If no TFCI is applied for a CCTrCH, TPC shall be transmitted using the first allocated channelisation code and the first allocated timeslot, according to the order in the higher layer allocation message. ~~The TPC is spread with the same spreading factor (SF) and spreading code as the data parts of the respective physical channel.~~

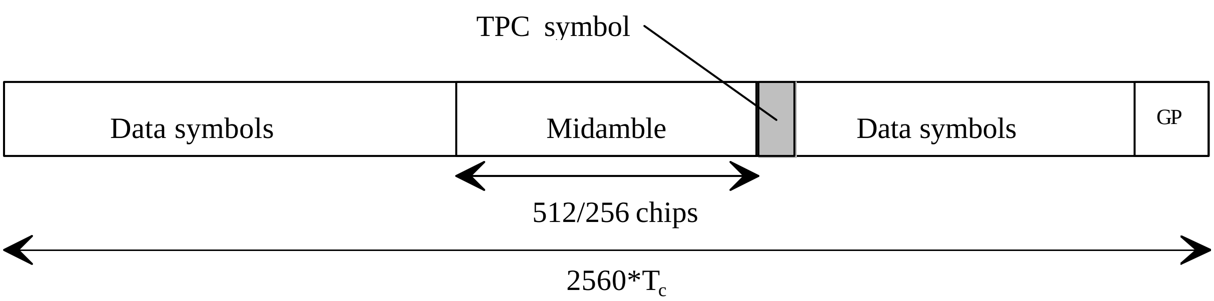

Figure 11: Position of TPC information in the traffic burst

5.2.2.3 Timeslot formats

5.2.2.3.1 Downlink timeslot formats

The downlink timeslot format depends on the spreading factor, midamble length and on the number of the TFCI bits, as depicted in the table 4a.

Table 5a: Time slot formats for the Downlink

Slot Format #	Spreading Factor	Midamble length (chips)	N_{TFCI} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data\ field}$ (bits)
0	16	512	0	244	244	122
1	16	512	4	244	240	120
2	16	512	8	244	236	118
3	16	512	16	244	228	114
4	16	512	32	244	212	106
5	16	256	0	276	276	138
6	16	256	4	276	272	136
7	16	256	8	276	268	134
8	16	256	16	276	260	130
9	16	256	32	276	244	122
10	1	512	0	3904	3904	1952
11	1	512	4	3904	3900	1950
12	1	512	8	3904	3896	1948
13	1	512	16	3904	3888	1944
14	1	512	32	3904	3872	1936
15	1	256	0	4416	4416	2208
16	1	256	4	4416	4412	2206
17	1	256	8	4416	4408	2204
18	1	256	16	4416	4400	2200
19	1	256	32	4416	4384	2192

5.2.2.3.2 Uplink timeslot formats

The uplink timeslot format depends on the spreading factor, midamble length, guard period length and on the number of the TFCI bits. Due to TPC, different amount of bits are mapped to the two data fields. The timeslot formats are depicted in the table 4b.

Table 5b: Timeslot formats for the Uplink

Slot Format #	Spreading Factor	Midamble length (chips)	Guard Period (chips)	N_{TFCI} (bits)	N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data field(1)}$ (bits)	$N_{data/data field(2)}$ (bits)
0	16	512	96	0	0	244	244	122	122
1	16	512	96	0	2	244	242	122	120
2	16	512	96	4	2	244	238	120	118
3	16	512	96	8	2	244	234	118	116
4	16	512	96	16	2	244	226	114	112
5	16	512	96	32	2	244	210	106	104
6	16	256	96	0	0	276	276	138	138
7	16	256	96	0	2	276	274	138	136
8	16	256	96	4	2	276	270	136	134
9	16	256	96	8	2	276	266	134	132
10	16	256	96	16	2	276	258	130	128
11	16	256	96	32	2	276	242	122	120
12	8	512	96	0	0	488~~488~~	488~~488~~	244~~244~~	244~~244~~
13	8	512	96	0	2	486~~488~~	484~~486~~	244~~244~~	240~~242~~
14	8	512	96	4	2	482~~488~~	476~~482~~	240~~242~~	236~~240~~
15	8	512	96	8	2	478~~488~~	468~~478~~	236~~240~~	232~~238~~
16	8	512	96	16	2	470~~488~~	452~~470~~	228~~236~~	224~~234~~
17	8	512	96	32	2	454~~488~~	420~~454~~	212~~228~~	208~~226~~
18	8	256	96	0	0	552~~552~~	552~~552~~	276~~276~~	276~~276~~
19	8	256	96	0	2	550~~552~~	548~~550~~	276~~276~~	272~~274~~
20	8	256	96	4	2	546~~552~~	540~~546~~	272~~274~~	268~~272~~
21	8	256	96	8	2	542~~552~~	532~~542~~	268~~272~~	264~~270~~
22	8	256	96	16	2	534~~552~~	516~~534~~	260~~268~~	256~~266~~
23	8	256	96	32	2	518~~552~~	484~~518~~	244~~260~~	240~~258~~
24	4	512	96	0	0	976~~976~~	976~~976~~	488~~488~~	488~~488~~
25	4	512	96	0	2	970~~976~~	968~~974~~	488~~488~~	480~~486~~
26	4	512	96	4	2	958~~976~~	952~~970~~	480~~486~~	472~~484~~
27	4	512	96	8	2	946~~976~~	936~~966~~	472~~484~~	464~~482~~
28	4	512	96	16	2	922~~976~~	904~~958~~	456~~480~~	448~~478~~
29	4	512	96	32	2	874~~976~~	840~~942~~	424~~472~~	416~~470~~
30	4	256	96	0	0	1104~~1104~~	1104~~1104~~	552~~552~~	552~~552~~
31	4	256	96	0	2	1098~~1104~~	1096~~1102~~	552~~552~~	544~~550~~
32	4	256	96	4	2	1086~~1104~~	1080~~1098~~	544~~550~~	536~~548~~
33	4	256	96	8	2	1074~~1104~~	1064~~1094~~	536~~548~~	528~~546~~
34	4	256	96	16	2	1050~~1104~~	1032~~1086~~	520~~544~~	512~~542~~
35	4	256	96	32	2	1002~~1104~~	968~~1070~~	488~~536~~	480~~534~~
36	2	512	96	0	0	1952~~1952~~	1952~~1952~~	976~~976~~	976~~976~~
37	2	512	96	0	2	1938~~1952~~	1936~~1950~~	976~~976~~	960~~974~~
38	2	512	96	4	2	1910~~1952~~	1904~~1946~~	960~~974~~	944~~972~~
39	2	512	96	8	2	1882~~1952~~	1872~~1942~~	944~~972~~	928~~970~~

Slot Format #	Spreading Factor	Midamble length (chips)	Guard Period (chips)	N_{TFCI} (bits)	N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data\ field(1)}$ (bits)	$N_{data/data\ field(2)}$ (bits)
40	2	512	96	16	2	1826~~1952~~	1808~~1934~~	912~~968~~	896~~966~~
41	2	512	96	32	2	1714~~1952~~	1680~~1918~~	848~~960~~	832~~958~~
42	2	256	96	0	0	2208~~2208~~	2208~~2208~~	1104~~1104~~	1104~~1104~~
43	2	256	96	0	2	2194~~2208~~	2192~~2206~~	1104~~1104~~	1088~~1102~~
44	2	256	96	4	2	2166~~2208~~	2160~~2202~~	1088~~1102~~	1072~~1100~~
45	2	256	96	8	2	2138~~2208~~	2128~~2198~~	1072~~1100~~	1056~~1098~~
46	2	256	96	16	2	2082~~2208~~	2064~~2190~~	1040~~1096~~	1024~~1094~~
47	2	256	96	32	2	1970~~2208~~	1936~~2174~~	976~~1088~~	960~~1086~~
48	1	512	96	0	0	3904~~3904~~	3904~~3904~~	1952~~1952~~	1952~~1952~~
49	1	512	96	0	2	3874~~3904~~	3872~~3902~~	1952~~1952~~	1920~~1950~~
50	1	512	96	4	2	3814~~3904~~	3808~~3898~~	1920~~1950~~	1888~~1948~~
51	1	512	96	8	2	3754~~3904~~	3744~~3894~~	1888~~1948~~	1856~~1946~~
52	1	512	96	16	2	3634~~3904~~	3616~~3886~~	1824~~1944~~	1792~~1942~~
53	1	512	96	32	2	3394~~3904~~	3360~~3870~~	1696~~1936~~	1664~~1934~~
54	1	256	96	0	0	4416~~4416~~	4416~~4416~~	2208~~2208~~	2208~~2208~~
55	1	256	96	0	2	4386~~4416~~	4384~~4414~~	2208~~2208~~	2176~~2206~~
56	1	256	96	4	2	4326~~4416~~	4320~~4410~~	2176~~2206~~	2144~~2204~~
57	1	256	96	8	2	4266~~4416~~	4256~~4406~~	2144~~2204~~	2112~~2202~~
58	1	256	96	16	2	4146~~4416~~	4128~~4398~~	2080~~2200~~	2048~~2198~~
59	1	256	96	32	2	3906~~4416~~	3872~~4282~~	1952~~2192~~	1920~~2190~~
60	16	512	192	0	0	232	232	122	110
61	16	512	192	0	2	232	230	122	108
62	16	512	192	4	2	232	226	120	106
63	16	512	192	8	2	232	222	118	104
64	16	512	192	16	2	232	214	114	100
65	16	512	192	32	2	232	198	106	92
66	8	512	192	0	0	464~~464~~	464~~464~~	232~~244~~	232~~220~~
67	8	512	192	0	2	462~~464~~	460~~462~~	232~~244~~	228~~218~~
68	8	512	192	4	2	458~~464~~	452~~458~~	228~~242~~	224~~216~~
69	8	512	192	8	2	454~~464~~	444~~454~~	224~~240~~	220~~214~~
70	8	512	192	16	2	446~~464~~	428~~446~~	216~~236~~	212~~210~~
71	8	512	192	32	2	430~~464~~	396~~430~~	200~~228~~	196~~202~~
72	4	512	192	0	0	928~~928~~	928~~928~~	464~~488~~	464~~440~~
73	4	512	192	0	2	922~~928~~	920~~926~~	464~~488~~	456~~438~~

Slot Format #	Spreading Factor	Midamble length (chips)	Guard Period (chips)	N_{TFCI} (bits)	N_{TPC} (bits)	Bits/slot	$N_{Data/Slot}$ (bits)	$N_{data/data\ field(1)}$ (bits)	$N_{data/data\ field(2)}$ (bits)
74	4	512	192	4	2	910~~928~~	904~~922~~	456~~486~~	448~~436~~
75	4	512	192	8	2	898~~928~~	888~~918~~	448~~484~~	440~~434~~
76	4	512	192	16	2	874~~928~~	856~~910~~	432~~480~~	424~~430~~
77	4	512	192	32	2	826~~928~~	792~~894~~	400~~472~~	392~~422~~
78	2	512	192	0	0	1856~~1856~~	1856~~1856~~	928~~976~~	928~~880~~
79	2	512	192	0	2	1842~~1856~~	1840~~1854~~	928~~976~~	912~~878~~
80	2	512	192	4	2	1814~~1856~~	1808~~1850~~	912~~974~~	896~~876~~
81	2	512	192	8	2	1786~~1856~~	1776~~1846~~	896~~972~~	880~~874~~
82	2	512	192	16	2	1730~~1856~~	1712~~1838~~	864~~968~~	848~~870~~
83	2	512	192	32	2	1618~~1856~~	1584~~1822~~	800~~960~~	784~~862~~
84	1	512	192	0	0	3712~~3712~~	3712~~3712~~	1856~~1952~~	1856~~1760~~
85	1	512	192	0	2	3682~~3712~~	3680~~3710~~	1856~~1952~~	1824~~1758~~
86	1	512	192	4	2	3622~~3712~~	3616~~3706~~	1824~~1950~~	1792~~1756~~
87	1	512	192	8	2	3562~~3712~~	3552~~3702~~	1792~~1948~~	1760~~1754~~
88	1	512	192	16	2	3442~~3712~~	3424~~3694~~	1728~~1944~~	1696~~1750~~
89	1	512	192	32	2	3202~~3712~~	3168~~3678~~	1600~~1936~~	1568~~1742~~

5.6.2 Midamble Allocation for UL Physical Channels

If the midamble is explicitly assigned by higher layers, an individual midamble shall be assigned to all UE's in one UL time slot.

If no midamble is explicitly assigned by higher layers, the UE shall derive the midamble from the assigned channelisation code that is used for the data part (except for TFCI/TPC) of the burst. The associations between midamble and channelisation code are the same as for DL physical channels. If the UE changes the SF according to the data rate, it shall always vary the channelisation code along the lower branch of the OVSF tree.

3GPP TSG RAN WG1 Meeting #17
Stockholm, Sweden, 21-24 November 2000

***Document* R1-001003**
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or for SMG, use the format P-99-xxx

CHANGE REQUEST

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25.222 CR 050 Current Version: 3.4.0

GSM (AA.BB) or 3G (AA.BBB) specification number ? *? CR number as allocated by MCC support team*

For submission to: RAN#10
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for approval	X
for information	

strategic		(for SMG use only)
non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: Siemens AG **Date:** 2000-10-29

Subject: Correction on TFCI & TPC Transmission

Work item:

Category:
(only one category shall be marked with an X)

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: Fixes the SF for the TFCI and TPC field to 16 in order to enable high repetition factors on the data field in case of low bit rates and low fixed SF.

Clauses affected: 4.2.7.1

Other specs Affected:

Other 3G core specifications	X	? List of CRs:	CR221-034
Other GSM core specifications		? List of CRs:	
MS test specifications		? List of CRs:	
BSS test specifications		? List of CRs:	
O&M specifications		? List of CRs:	

Other comments: This CR clarifies the usage of minimum SF in the RM section.

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4.2.7.1 Determination of rate matching parameters

The following relations, defined for all TFC *j*, are used when calculating the rate matching pattern:

$$Z_{0,j} = 0$$

$$Z_{i,j} = \left\lfloor \frac{\left(\sum_{m=1}^{i} RM_m \cdot N_{m,j} \right) \cdot N_{data,j}}{\sum_{m=1}^{I} RM_m \cdot N_{m,j}} \right\rfloor \quad \text{for all i = 1 … } I \text{ (1)}$$

$$\Delta N_{i,j} = Z_{i,j} - Z_{i-1,j} - N_{i,j} \quad \text{for all i = 1 … } I$$

Puncturing can be used to minimise the required transmission capacity. The maximum amount of puncturing that can be applied is 1-Pl, PL is signalled from higher layers. The possible values for N_{data} depend on the number of physical channels P_{max}, allocated to the respective CCTrCH, and on their characteristics (spreading factor, length of midamble and TFCI, usage of TPC and multiframe structure), which is given in [7].

Denote the number of data bits in each physical channel by $U_{p,Sp}$, where *p* refers to the sequence number $1 \le p \le P_{max}$ of this physical channel in the allocation message, and the second index *Sp* indicates the spreading factor with the possible values {*16, 8, 4, 2, 1*}, respectively. For each physical channel an individual minimum spreading factor Sp_{min} is transmitted by means of the higher layer. There are two options to determine the number N_{data} from the number of possible physical channels and the minimum spreading factor. The option is signalled by means of the higher layers.

If the UE shall increase the spreading factor autonomously, ~~Then,~~ for N_{data} one of the following values in ascending order can be chosen:

$$\left\{ U_{1,16},\ldots,U_{1,S1_{min}}, U_{1,S1_{min}} + U_{2,16},\ldots,U_{1,S1_{min}} + U_{2,S2_{min}},\ldots,U_{1,S1_{min}} + U_{2,S2_{min}} + \ldots + U_{P_{max},16},\ldots,U_{1,S1_{min}} + U_{2,S2_{min}} + \ldots + U_{P_{max},SP_{max,min}} \right\}$$

If the UE shall only use the minimum spreading factor, for N_{data} one of the following values in ascending order can be chosen:

$$\left\{ U_{1,S1_{min}}, U_{1,S1_{min}} + U_{2,S2_{min}}, U_{1,S1_{min}} + U_{2,S2_{min}} + \ldots + U_{P_{max},SP_{max,min}} \right\}$$

$N_{data,j}$ for the transport format combination j is determined by executing the following algorithm:

$$\text{SET1} = \{ N_{data} \text{ such that } \left(\min_{1 \le y \le I} \{RM_y\} \right) \cdot N_{data} - PL \cdot \sum_{x=1}^{I} RM_x \cdot N_{x,j} \text{ is non negative } \}$$

$$N_{data,j} = \min \text{SET1}$$

The number of bits to be repeated or punctured, $\Delta N_{i,j}$, within one radio frame for each TrCH i is calculated with the relations given at the beginning of this subclause for all possible transport format combinations j and selected every radio frame.

If $\Delta N_{i,j} = 0$ then the output data of the rate matching is the same as the input data and the rate matching algorithm of subclause 4.2.7.3 does not need to be executed.

Otherwise, the rate matching pattern is calculated with the algorithm described in subclause 4.2.7.3. For this algorithm the parameters e_{ini}, e_{plus}, e_{minus}, and X_i are needed, which are calculated according to the equations in subclauses 4.2.7.1.1 and 4.2.7.1.2.