3GPP TSG RAN #22 **Tdoc RP-030708**

Maui, Hawaii

9 - 12 December 2003

Agenda Item: **9.2**

Source: **IPWireless, Orange**

Title: **Service Continuity Between 3GPP Releases 4 and 5 for TDD**

Document for: **Decision**

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1 Background

Current releases of the 3GPP specifications make provision for shared channel usage in TDD. For Releases 99 and 4, this is accomplished via the DSCH for downlink, and via the USCH for uplink. The two may coexist and may additionally be used in CELL_DCH state or in CELL_FACH state.

Support for DSCH and USCH is optional in the UE, and of course also within UTRAN. Network operators are currently free to choose whether services and traffic types that may benefit from shared channel usage are indeed mapped onto shared channels based upon the UE capability information and the network's radio resource management policies.

Existing TDD deployments (based upon Releases 99 and 4) actively utilise shared channel functionality and TDD shared channels are in use around the world.

At the current time, manufacturers and operators are considering migration to Release 5. Support for the downlink shared channel (DSCH) has been enhanced in Release 5 with the provision of a more efficient and higher-speed shared channel, the HS-DSCH. No enhancements to the USCH were included within Release 5.

It is natural that network operators wish to benefit from the new Release 5 functionality and would thus like to operate HS-DSCH in the downlink (in preference to the DSCH) for suitable traffic types and services. The HS-DSCH substitutes the DSCH for those UE's supporting the new Release 5 functionality.

Due to the fact that no modifications to USCH operation were made in the transition between Release 4 and 5, the USCH continues to represent the state-of-the-art for uplink traffic types and services suited to TDD shared channel operation.

The USCH will remain the uplink state of the art for TDD shared channel operation until uplink shared channel functionality is superseded by an improved technology. It is thought that such a successor is likely to emerge from the current RAN WG1 study item "Feasibility Study on Uplink Enhancements for UTRA TDD" and this will provide a degree of convergence between uplink packet data provisioning in FDD and in TDD in a future release (both using their new respective enhanced uplink features).

In Releases 99 and 4, uplink and downlink shared channels can be utilised together (they are not mutually exclusive), and it is reasonable to expect that this functionality will be continued into Releases 5, 6 and beyond for the conveyance of uplink and downlink packet data:-

?? In Release 5 TDD, the state of the art in downlink shared channels is the HS-DSCH, and in uplink shared channels is the USCH, and as such it is expected that these uplink and downlink packet services may co-exist simultaneously

?? In a future release, the state of the art in the uplink is expected to move to an enhanced uplink. In such a release, it is expected that the enhanced uplink and HS-DSCH may co-exist simultaneously. Furthermore, in such a release, it is likely that simultaneous support of USCH and the enhanced uplink will not be required

This expectation for Release 5 has been realised within the core specifications across all RAN WG's 1, 2, 3 and 4. The core specifications all fully support the simultaneous use of HS-DSCH and USCH in Release 5. However, a problem has been identified with a stage 2 document under RAN WG2 control, wherein a contradiction with these core specifications exists. This document is entitled "Services Provided by the Physical Layer" TS 25.302, and the latest version is v5.6.0.

Within TS 25.302, tables of physical channel combinations which are allowed to exist within the same radio frame are listed. These tables are separate for uplink (table 8.3) and downlink (table 8.4). The table for the uplink currently precludes simultaneous operation of HS-DSCH related uplink signaling channels with USCH.

No historical documentary evidence of the reasoning behind this decision (to remove USCH functionality) exists and furthermore during subsequent and recent discussions on this topic, no substantiated technical concerns prevail.

It has been the understanding of the companies providing signature to this document that it was always the intention within Release 5 to incrementally add new features (eg: HS-DSCH), and that all previously supported features would continue to be supported to the maximum extent possible. It was not the understanding that features unrelated to the introduction of HS-DSCH would be discontinued.

This understanding is also clearly reflected in the following extracts from the RAN HSDPA work item objectives handed down to RAN WG1, WG2, and WG3 for Release 5 :

<< start of extract >>

3.1.1 High Speed Downlink Packet Access (HSDPA) - *Physical Layer*

Last distributed as: RP-010915 (originally RP-010262)

…..

4 Objective

The technical objective of this work item is the integration of HSDPA physical layer functionality in UTRA, while maintaining commonality with the R99 general physical layer aspects to the maximum extent possible.

<< end of extract >>

<< start of extract >>

3.1.2 High Speed Downlink Packet Access (HSDPA) - *layer 2 and 3 aspects*

Last distributed as: RP-010915 (originally RP-010262)

…….

4 Objective

The technical objective of this work item is the integration of HSDPA physical layer functionality in UTRA, while maintaining commonality with the R99 general layer 2 and 3 aspects to the maximum extent possible. While most of the control aspects will be identical to those for R99, some additional signaling for the configuration of HSDPA channels will need to be defined. Also, in order to enable the support of fast scheduling, support for a new MAC-HSDSCH entity shall be included. This new entity at the Node B will handle all the scheduling and HARQ (non-physical layer aspects) of the HSDPA feature. UE capabilities will need to be updated to indicate support of HSDPA. Physical Layer aspects of UE capabilities will be handled by WG1.

<< end of extract >>

<< start of extract >>

3.1.3 High Speed Downlink Packet Access (HSDPA) - *Iub/Iur Protocol Aspects*

Last distributed as: RP-010915 (originally RP-010262)

……

4 Objective

The technical objective of this work item is the integration of HSDPA physical layer functionality in UTRA, while maintaining commonality with the R99 general Iub and Iur aspects to the maximum extent possible. While most of the control aspects will be identical to those for R99, some additional signaling for the configuration of HSDPA shared channels will need to be defined. Also frame protocol for the user data stream will need to be defined for the HSDPA shared channels. Flow control for the HSDPA channels on the Iub will need to be supported.

<< end of extract >>

2 Conclusions

Given the discussion of section 1 the following conclusions are drawn :

1. Continuing support for the USCH simultaneously with HS-DSCH in Release 5 is essential if the benefits of HS-DSCH are to be exploited whilst maintaining continuity of uplink service between Release 5 and earlier TDD releases

2. Continuity of uplink service and continuing support for the USCH in TDD is of paramount importance given the existing use of the USCH in current real-world deployments

3. TS 25.302 is in contradiction with all other relevant core 3GPP RAN specifications for Release 5 and could be aligned via the simple inclusion of uplink physical channel combinations of HS-SICH and PUSCH/PRACH (an example of such a correction is given in [2] and in annex A of this document. Note that in addition to clarifying this particular situation, these CR's also contain general corrections intended to align 25.302 with certain details of the Release 5 physical layer for TDD)

4. No technical problems have been identified with the simultaneous operation of HS-DSCH and USCH in TDD Release 5 from RAN WG1, WG2, WG3 or WG4 perspectives

5. Support of USCH in release 5 does not place any undue constraints or pressures on equipment manufacturers due to the fact that support for PUSCH remains optional in both UTRAN and the UE.

6. Simultaneous use of USCH with HS-DSCH in Release 5 provides a viable migration path for packet switched services in TDD between Release 4 (USCH and DSCH) and Release 6+ (HS-DSCH and enhanced-UL).

A clarification of whether the USCH is supported simultaneously with HS-DSCH in TDD Release 5 is sought from RAN.

3 References

[1] R1-031387, "[DRAFT] LS on co-location of HS physical channels with R99 physical channels in the same radio frame for TDD", RAN WG1 #35, Lisbon, Portugal, 17-21 November 2003, IPWireless, Orange, Alcatel, eAccess

[2] R2-032331, "Addition of missing TDD physical channel combinations", RAN WG2 #39, San Diego, USA, 17-21 November 2003, IPWireless, Orange, Alcatel

[3] "Draft 0 Minutes of the 39th TSG-RAN WG2 meeting", Distributed on the RAN WG2 reflector by the secretariat, 24th November 2003 following RAN WG2 #39, San Diego, USA, 17-21 November 2003

Annex A – Proposed Corrections to 25.302 for TDD Release 5

3GPP TSG-RAN Meeting #22
Maui, Hawaii, 9th – 12th December 2003

Tdoc ✍RP-03xxxx - DRAFT

CR-Form-v7

CHANGE REQUEST

✍ **25.302** **CR** **CRNum** ✍ **rev** **-** ✍ Current version: **5.6.0** ✍

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ✍ symbols.*

Proposed change affects: UICC apps ✍ ☐ ME ☒ Radio Access Network ☐ Core Network ☐

Title: ✍	Addition of missing TDD Physical Channel Combinations	
Source: ✍	IPWireless, Orange, Alcatel	
Work item code: ✍	TEI5	***Date:*** ✍ 08/11/03
Category: ✍	**F**	***Release:*** ✍ Rel-5

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*

Reason for change: ✍

Physical channel combinations allowing the use of uplink shared channels concurrently with HS channels are missing from table 3 and 5 for 3.84Mcps TDD. Also the current text precludes the use of fractionated DPCH's when using HSDPA services. Furthermore, the existing physical channel combinations are inconsistent with HS-DSCH operation decriptions in RAN1 specifications (specifically 25.221) in so far as HS-SCCH can allocate resources in the current or subsequent frame.

Summary of change: ✍

The missing physical channel combinations are added to tables 3 and 5.

These changes are categorised as follows:

1. Cell_DCH state is needed for HS-DSCH operation, however, the DPCH can be fractionated (i.e. it has a repetition period greater than 1). This means that physical channels required for HS-DSCH operation can be present even though no DPCH is present.
2. HS-SCCH can allocate HS-PDSCH resources in the current frame

	or subsequent frame and therefore HS-SCCH and HS-PDSCH physical channels can exist separately. 3. Uplink shared channel operation is still possible with HS-DSCH operation in the downlink. Therefore combinations required to support this operation are added. **Isolated impact analysis:** Isolated impact statement: Correction to a function where specification was not sufficiently explicit. The change is isolated to 3.84 Mcps TDD and the UE only.
Consequences if not approved:	Misinterpretation of L1 capabilities may mean that fractionated DCH are not employed with HS-DSCH operation. Similarly uplink shared channels may not be used with HS-DSCH operation.

Clauses affected:	8.3.1, 8.4.1			
Other specs affected:	**Y**	**N**		
		X	Other core specifications	
		X	Test specifications	
		X	O&M Specifications	
Other comments:	None			

8.3 TDD Uplink

8.3.1 3.84 Mcps TDD Uplink

The table addresses the possible combinations of 3.84 Mcps TDD physical channels that can be supported in the uplink by one UE simultaneously on the same frequency in any one 10ms frame. In 3.84 Mcps TDD a physical channel corresponds to one code, one timeslot and one frequency.

Table 3: 3.84 Mcps TDD Uplink

	Physical Channel Combination	Transport Channel Combination	Mandatory or dependent on UE radio access capabilities	Comment
1	PRACH	RACH	Mandatory	
2	DPCH	One or more DCH coded into a single CCTrCH	Mandatory	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities. This combination is used as reference measurement channel.
3	One or more than one DPCH	One or more DCH coded into one or more CCTrCH	Depending on UE radio access capabilities	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities.
4	PRACH + one or more DPCH	RACH + one or more DCH coded into one or more CCTrCH	Depending on UE radio access capabilities	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities. This combination may be used for shared channel operation only. At least the usage of two timeslots is required.
5	One or more PUSCH	One or more USCH coded onto one or more CCTrCH	Depending on UE radio access capabilities	This combination is used for shared channel operation.
6	PRACH + one or more PUSCH	RACH + One or more USCH coded onto one or more CCTrCH	Depending on UE radio access capabilities	This combination may be used for shared channel operation only. At least the usage of two timeslots is required.
7	One or more PUSCH + one or more DPCH	One or more USCH coded onto one or more CCTrCH + one or more DCH coded into one or more CCTrCH	Depending on UE radio access capabilities	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities. This combination may be used for shared channel operation.
8	PRACH + one or more PUSCH + one or more DPCH	RACH + one or more USCH coded onto one or more CCTrCH + one or more DCH coded into one or more CCTrCH	Depending on UE radio access capabilities	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities. This combination may be used for shared channel operation. At least the usage of two timeslots is required.

	Physical Channel Combination	Transport Channel Combination	Mandatory or dependent on UE radio access capabilities	Comment
9	Zero, ~~One~~ one or more DPCH + HS-SICH	Zero, o~~O~~ne or more DCH coded into zero, one or more CCTrCH	Depending on UE radio access capabilities	Transmission of the HS-SICH physical channel is required for reporting of HS-DSCH ACK/NACK and CQI. The UE must be in cell_DCH state to use HS-PDSCH. However the DPCH can have a repetition period g reater than 1 and in this case HS-SICH can be transmitted by the UE without a simultaneous DPCH.
10	PRACH + zero, one or more DPCH + one or more HS-SICH + zero one or more PUSCH	RACH + zero, one or more DCH coded into zero, one or more CCTrCH +zero one or more USCH coded into zero one or more CCTrCH	Depending on UE radio access capabilities	Transmission of the HS-SICH physical channel is required for reporting of HS-DSCH ACK/NACK and CQI. This combination may be used for uplink shared channel operation. At least the usage of two timeslots is required. The UE must be in cell_DCH state to use HS-PDSCH. However the DPCH can have a repetition period greater than 1 and in this case HS-SICH can be transmitted by the UE without a simultaneous DPCH.
11	zero, one or more DPCH + one or more HS-SICH + zero one or more PUSCH	zero, one or more DCH coded into zero, one or more CCTrCH +zero one or more USCH coded into zero one or more CCTrCH	Depending on UE radio access capabilities	Transmission of the HS-SICH physical channel is required for reporting of HS-DSCH ACK/NACK and CQI. This combination may be used for uplink shared channel operation. At least the usage of two timeslots is required. The UE must be in cell_DCH state to use HS-PDSCH. However the DPCH can have a repetition period greater than 1 and in this case HS-SICH can be transmitted by the UE without a simultaneous DPCH.

8.4 TDD Downlink

8.4.1 3.84 Mcps TDD Downlink

The table describes the possible combinations of 3.84 Mcps TDD physical channels that can be supported in the downlink by one UE simultaneously on the same frequency in any one 10ms frame, where a 3.84 Mcps TDD physical channel corresponds to one code, one timeslot and one frequency.

Depending on UE radio capabilities UEs may be required to decode occasionally P-CCPCH of its own cell in the following Physical Channel Combinations to maintain open loop power control and/or acquire parameters for RACH access: 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18.

Depending on UE radio capabilities UEs may be required to decode occasionally one P-CCPCH of neighbour cells in the following Physical Channel Combinations for handover: 6, 8, 11, 12, 13, 14, 15, 16, 17.

Table 5: 3.84 Mcps TDD Downlink

	Physical Channel Combination	Transport Channel Combination	Mandatory or dependent on UE radio access capabilities	Comment
1	P-CCPCH + One S-CCPCH	BCH and PCH and/or one or more FACH	Mandatory	
2	P-CCPCH	BCH	Mandatory	
3	S-CCPCH	FACH or/and PCH	Mandatory	
4	More than one S-CCPCH	one or more FACH+ one or more PCH	Depending on UE capabilities	
5	PICH	N/A	Mandatory	
6	Three or more DPCH	One or more DCH coded into one or more CCTrCH	Depending on UE radio access capabilities	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities .
7	One or two DPCH	One or more DCH coded into a single CCTrCH	Mandatory	This combination is used for reference measurement channel.
8	One or more S-CCPCH + one or more DPCH	PCH and/or one or more FACH + one or more DCH coded into one or more CCTrCH	Depending on UE radio access capabilities	The number of DCHs and the maximum channel bit rate are dependent on the UE radio access capabilities. This combination is used for shared channel operation only.
9	One or more PDSCH	One or more DSCH coded onto one or more CCTrCH	Depending on UE radio access capabilities	This combination is used for shared channel operation.
10	One or more PDSCH + one or more S-CCPCH	PCH and/or one or more FACH + one or more DSCH coded onto one or more CCTrCH	Depending on UE radio access capabilities	This combination is used for shared channel operation.

	Physical Channel Combination	Transport Channel Combination	Mandatory or dependent on UE radio access capabilities	Comment
11	One or more PDSCH + one or more DPCH	One or more DSCH coded onto one or more CCTrCH + one or more DCH coded into one or more CCTrCH	Depending on UE radio acœss capabilities	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities . This combination is used for shared channel operation.

	Physical Channel Combination	Transport Channel Combination	Mandatory or dependent on UE radio access capabilities	Comment
12	One or more PDSCH + one or more S-CCPCH + one or more DPCH	PCH and/or one or more FACH + one or more DSCH coded onto one or more CCTrCH + one or more DCH coded into one or more CCTrCH	Depending on UE radio access capabilities	The maximum number of DCHs and the maximum channel bit rate are dependent on UE radio access capabilities. This combination is used for shared channel operation.
13	Zero, oOne or more DPCH + one or more HS-PDSCH + one or more HS-SCCH	Zero, oOne or more DCH coded into zero, one or more CCTrCH + one or more HS-DSCH coded into one CCTrCH	Depending on UE radio access capabilities	HS-SCCH can allocate HS-PDSCH resources in the current frame or subsequent frame. This combination is required for the case of the allocation in the current frame. The UE must be in cell_DCH state to use HS-PDSCH. However the DPCH can have a repetition period greater than 1 and therefore DPCH does not have to be simultaneously present in this case.
14	Zero, one or more DPCH + one or more HS-PDSCH	Zero, one or more DCH coded into zero, one or more CCTrCH + one or more HS-DSCH coded into one CCTrCH	Depending on UE radio access capabilities	HS-SCCH can allocate HS-PDSCH resources in the current frame or subsequent frame. This combination may arise for the case of the allocation in the subsequent frame. The UE must be in cell_DCH state to use HS-PDSCH. However the DPCH can have a repetition period greater than 1 and therefore DPCH does not have to be simultaneously present in this case.
15	Zero, one or more DPCH + One or more HS-SCCH	Zero, one or more DCH coded into zero, one or more CCTrCH	Depending on UE radio access capabilities	HS-SCCH can allocate HS-PDSCH resources in the current frame or subsequent frame. This combination is required for the case of the allocation in subsequent frame. The UE must be in cell_DCH state to use HS-PDSCH. However the DPCH can have a repetition period greater than 1 and therefore DPCH does not have to be present in this case.
16	One or more S-CCPCH + Zero, one or more DPCH + one or more HS-PDSCH + one or more HS-SCCH	PCH and/or one or more FACH + zero, one or more DCH coded into zero, one or more CCTrCH + one or more HS-DSCH coded into one CCTrCH	Depending on UE radio access capabilities	This combination is used for uplink shared channel operation. HS-SCCH can allocate HS-PDSCH resources in the current frame or subsequent frame. This combination is required for the case of the allocation in the current frame. The UE must be in cell_DCH state to use HS-PDSCH. However the DPCH can have a repetition period greater than 1 and therefore DPCH does not have to be simultaneously present in this case.

	Physical Channel Combination	Transport Channel Combination	Mandatory or dependent on UE radio access capabilities	Comment
17	One or more S-CCPCH + Zero, one or more DPCH + one or more HS-PDSCH	PCH and/or one or more FACH + zero, one or more DCH coded into zero, one or more CCTrCH + one or more HS-DSCH coded into one CCTrCH	Depending on UE radio access capabilities	This combination is used for uplink shared channel operation. HS-SCCH can allocate HS-PDSCH resources in the current frame or subsequent frame. This combination may arise for the case of the allocation in the subsequent frame. The UE must be in cell_DCH state to use HS-PDSCH. However the DPCH can have a repetition period greater than 1 and therefore DPCH does not have to be simultaneously present in this case.
18	One or more S-CCPCH + Zero, one or more DPCH + One or more HS-SCCH	PCH and/or one or more FACH + zero, one or more DCH coded into zero, one or more CCTrCH	Depending on UE radio access capabilities	This combination is used for uplink shared channel operation. HS-SCCH can allocate HS-PDSCH resources in the current frame or subsequent frame. This combination is required for the case of the allocation in subsequent frame. The UE must be in cell_DCH state to use HS-PDSCH. However the DPCH can have a repetition period greater than 1 and therefore DPCH does not have to be present in this case.
NOTE: Reference: [12].				