3GPP TSG RAN WG2 Meeting #6 **RAN WG2 779/99**
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Source: **InterDigital**

Title: **TDD Specific Parameters for the RRC Messages**

Document For: **Decision**

Introduction:

This document proposes definitions of additional RRC parameters and Information Elements (IE) that are unique to TDD mode. Restructuring where the TDD time slot parameter is maintained is also suggested.

Since the mandatory or optional parameter type for TDD is not always the same for FDD, the following change request identifies TDD and FDD in separate columns.

Discussion:

1. Time Slot Identification in TDD Mode:

   Currently time slots are identified in the Uplink Time Slot Info and Downlink Time Slot Info IE's, which are independent of the physical channel IE's that include the channelization code. In TDD a physical channels time slot is associated with it's chanelization code. To maintain this information in common IE's, the following changes are proposed:

   a) Remove *Uplink Time Slot Info* and *Uplink Time Slot Info* IEs from the following messages:
      i. HANDOVER COMMAND
      ii. RRC CONNECTION SETUP
      iii. PHYSICAL CHANNEL RECONFIGURATION
      iv. RADIO ACCESS BEARER RECONFIGURATION
      v. RADIO ACCESS BEARER RELEASE
      vi. RADIO ACCESS BEARER SETUP
      vii. TRANSPORT CHANNEL RECONFIGURATION
   b) Add *Time Slot* parameter for the following physical channel IEs:
      i. Secondary CCPCH Info
      ii. PRACH Info
      iii. Uplink DPCH Info
      iv. Downlink DPCH Info
   c) Remove the following note from the above mentioned messages:
      "Note 1: It is assumed that the DL timeslot configuration is the same for all radio links, whether or not macro-diversity is supported for TDD"
      This assumption is no longer necessary since the time slot is specified for each physical channel.

   This also corrects the System Information Message, which did not indicate time slot information for the secondary CCPCH channel.

2. *Channelization Code* parameter for the *PRACH Info* IE*:*
   In TDD it is necessary to specify the *Channelization Code* for each *PRACH channel.* Therefore it is proposed to add this parameter to the PRACH Info IE (RRC Protocol Specification section 10.2.6.4 PRACH info).
   .
3. *Spreading Factor* parameter for DPCH channels:
   Every dedicated channel in TDD may have a different Spreading Factor (SF), particularly if they resided in different time slots. Therefore, it is proposed to add the SF parameter to the *Uplink DPCH info* and the *Downlink DPCH info* IEs (RRC Protocol Specification sections 10.2.6.6 Uplink DPCH info, and 10.2.6.8 Downlink DPCH info).

4. System Information identification of cell sync case and neighbor cell information:
   It is proposed to add the following IEs to the System Information message:

   a) Sync Info:
      This IE provides the necessary information to establish frame synchronization.

      There are three synchronization cases in TDD:
      - Case 1: One PSCH (Physical Synch Channel) every 10ms DL frame
        BCH in the same time slot as PSCH
      - Case 2: Two PSCH channels every 10ms DL frame
        BCH in the same time slots as PSCH
      - Case 3: Two PSCH channels every 10ms DL frame
        BCH location is found by a pointer (3 extra bits that are used for that purpose)

      The first PSCH time slot is always indicated by the value k. The second PSCH time slot (for case 2, and 3) can be found in k+8.

      After the PSCH channel is found, the BCH channel can be determined. Since the value k (the PSCH time slot) is not given, the beginning of the frame can not be determined.

      Therefore, it is proposed to include the value k as a parameter “PSCH Time Slot (k)” of the Sync Info IE to the System Information message.

   b) Neighboring cells Sync info:
      This IE provides information about the neighboring cells sync and broadcast channels. This information is required to avoid going through the time consuming cell search algorithm for each of the neighboring cell. The following parameters should be defined.
      i. Cell Parameter
         This parameter serves as an index to a Look-Up-Table that provides the following information:
         - DL Scrambling code
         - Toffset: The amount of chips the primary synchronization code (Cp) is offset from the start of the timeslot.
         - Midamble code
         - Cs pattern: Pattern of 8 secondary synchronization codes (Cs)
      ii. Sync time slot (k can take the values 0 - 14)
      iii. Sync case (1,2, or 3)
      iv. BCH (CCPCH) pointing bits (only for sync case 3)

Proposed Changes to the RRC Protocol Specification (25.331) for removal of UL&DLTime Slot IE's:

10.1 Radio Resource Control messages

10.1.1 RRC Connection Mobility Messages

10.1.1.5 HANDOVER COMMAND

<Functional description of this message to be included here>
RLC-SAP: t.b.d.
Logical channel: DCCH
Direction: UTRAN → UE

Information element category	**Information elements**	**REFERENCE**	**TYPE (TDD)**	**TYPE (FDD)**	**NOTE**	
	Message Type		M	M		
Phy CH information elements	Frequency info		M	M		
	UL DPCH power control info		M	M		
	UL DPCH info		M	M		Uplink radio resources
	~~UL timeslot info~~			~~O~~		
	Primary CCPCH info		M	M	For each radio link. Note1	Downlink radio resources
	DL DPCH info		M	M		
	~~DL timeslot info~~			~~O~~	~~Note 2~~	
	SSDT indicator		O	O		

Note1: The possibility to request the establishment of several radio links simultaneously with this message is FFS.
~~Note 2: It is assumed that the DL timeslot configuration is the same for all radio links, whether or not macro-diversity is supported for TDD.~~

10.1.4.7 RRC CONNECTION SETUP

This message is used by the network to accept the establishment of an RRC connection for an UE, including assignment of signalling link information, transport channel information and optionally physical channel information.
RLC-SAP: t.b.d.
Logical channel: CCCH
Direction: UTRAN → UE

Information element category	Information elements	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE	
	Message Type		M	M		
UE information elements	Initial UE identity		M	M	FFS whether conveyed on RRC or MAC.	
	S-RNTI		M	M		
	SRNC identity		M	M		
	C-RNTI		O	O	Only if assigned to a common transport channel	
	Activation time		O	O		
RAB information elements	RAB identity		M	M	Indicates the signalling link	
	Signalling link type		M	M		
	RAB multiplexing info		M	M	For the signalling link	
TrCH information elements	TFCS		O	O	Uplink TFCS	
	TFCS		O	O	Downlink TFCS	
	TFC subset		O	O		
	Transport channel identity		M	M	For each new transport channel	Uplink transport channels
	TFS		M	M		
	Transport channel identity		M	M	For each new transport channel	Downlink transport channels
	TFS		M	M		
PhyCH information elements	Frequency info		O	O		
	Uplink DPCH power control info		O	O		
	Uplink DPCH info		O	O	Maximum one of these	Uplink radio resources
	PRACH info		O	O		
	~~Uplink timeslot info~~			~~O~~		
	Primary CCPCH info		O	O	For each radio link	Downlink radio resources
	Downlink DPCH info		O	O		
	Secondary CCPCH info		O	O		
	~~Downlink timeslot info~~			~~O~~	~~Note 1~~	
	SSDT indicator		O	O	Necessity is FFS	
	Gated Transmission Control info		O	O	FFS	

~~Note 1: It is assumed that the DL timeslot configuration is the same for all radio links, whether or not macro-diversity is supported for TDD.~~

10.1.5.1 PHYSICAL CHANNEL RECONFIGURATION

This message is used by UTRAN to assign, replace or release a set of physical channels used by a UE.
RLC-SAP: t.b.d.
Logical channel: DCCH
Direction: UTRAN → UE

Information element category	Information elements	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE
	Message Type		M	M	
UE Information elements	Activation time		O	O	
	C-RNTI		O	O	Only RACH/FACH
UTRAN mobility Information elements	URA update indicator		O	O	When PCH shall be used, and when present, it instructs the UE to make URA updating
PhyCH information elements	Uplink DPCH power control info		O	O	
	Frequency info		O	O	
	Uplink DPCH info		O	O	Maximum one of these; Uplink radio resources
	PRACH info		O	O	
	~~Uplink time slot info~~			~~O~~	
	Primary CCPCH info		O	O	For each radio link; Downlink radio resources
	Downlink DPCH info		O	O	
	Secondary CCPCH info		O	O	For FACH
	Secondary CCPCH info		O	O	For PCH
	~~Downlink timeslot info~~			~~O~~	~~Note 1~~
	SSDT indicator		O	O	Necessity is FFS
	Gated Transmission Control info		O	O	FFS

~~Note 1: It is assumed that the DL timeslot configuration is the same for all radio links, whether or not macro-diversity is supported for TDD.~~

10.1.5.3 RADIO ACCESS BEARER RECONFIGURATION

This message is sent from UTRAN to reconfigure parameters related to a change of QoS. This procedure can also change the multiplexing of MAC, reconfigure transport channels and physical channels.
RLC-SAP: t.b.d.
Logical channel: DCCH
Direction: UTRAN → UE

Information element category	Information elements	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE	
	Message Type		M	M		
UE Information elements	Activation time		O	O		
	C-RNTI				Only RACH/FACH	
RAB information elements	RAB identity		M	M		For each RAB affected by this message
	RLC info		O	O	FFS	
	RAB multiplexing info		M	M		
TrCH information elements	TFCS		O	O	for uplink DCHs	
	TFCS		O	O	for downlink DCHs	
	TFC subset		O	O	for DCHs in uplink	
	Transport channel identity		O	O	For each removed transport channel	Uplink transport channels
	Transport channel identity		O	O	For each reconfigured or added transport channel	
	TFS		O	O		
	Dynamic Control		O	O	For each reconfigured or added transport channel controlled by DRAC	
	Transmission time validity		O	O		
	Time duration before retry		O	O		
	Silent period duration before release		O	O		
	Transport channel identity		O	O	For each removed transport channel	Downlink transport channels
	Tranpsort channel identity		O	O	For each reconfigured or added transport channel	
	TFS		O	O		
PhyCH information elements	Uplink DPCH power control info		O	O		
	Frequency info		O	O		
	Uplink DPCH info		O	O	Maximum one of these	Uplink radio resources
	PRACH info		O	O		
	~~Uplink timeslot info~~			~~O~~		
	Primary CCPCH info		NA	O	For each radio link	Downlink radio resources
	Downlink DPCH info		O	O		
	Secondary CCPCH info		O	O		
	~~Downlink timeslot info~~			~~O~~	~~Note 1~~	
	SSDT indicator		O	O	Necessity is FFS	
	Gated Transmission Control info		O	O	FFS	

~~Note 1: It is assumed that the DL timeslot configuration is the same for all radio links, whether or not macro-diversity is supported for TDD.~~

10.1.5.5 RADIO ACCESS BEARER RELEASE

<Functional description of this message to be included here>
RLC-SAP: t.b.d.
Logical channel: DCCH
Direction: UTRAN → UE

Information element category	Information elements	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE	
	Message Type		M	M		
UE Information elements	Activation time		O	O		
	C-RNTI		O	O	Only RACH/FACH	
RAB information elements	RAB identity		M	M	For each released RAB	
	RAB identity		O	O	For each other RAB affected by this message	
	RAB multiplexing info		O	O		
TrCH information elements	TFCS		O	O	for uplink DCHs	
	TFCS		O	O	for downlink DCHs	
	TFC subset		O	O	for DCHs in uplink	
	Transport channel identity		O	O	For each removed transport channel	Uplink transport channels
	Transport channel identity		O	O	For each reconfigured or added (FFS) transport channel	
	TFS		O	O		
	Dynamic Control		O	O	For each reconfigured or added (FFS) transport channel, controlled by DRAC	
	Transmission time validity		O	O		
	Time duration before retry		O	O		
	Silent period duration before release		O	O		
	Transport channel identity		O	O	For each removed transport channel	Downlink transport channels
	Transport channel identity		O	O	For each reconfigured or added transport channel	
	TFS		O	O		
PhyCH information elements	Uplink DPCH power control info		O	O		
	Frequency info		O	O		
	Uplink DPCH info		O	O	Maximum one of these	Uplink radio resources
	PRACH info		O	O		
	~~Uplink timeslot info~~			~~O~~		
	Primary CCPCH info		O	O	For each radio link	Downlink radio resources
	Downlink DPCH info		O	O		
	Secondary CCPCH info		O	O		
	~~Downlink timeslot info~~			~~O~~	~~Note 1~~	

~~Note 1: It is assumed that the DL timeslot configuration is the same for all radio links, whether or not macro-diversity is supported for TDD.~~

10.1.5.7 RADIO ACCESS BEARER SETUP

<*Functional description of this message to be included here*>
RLC-SAP: t.b.d.
Logical channel: DCCH
Direction: UTRAN → UE

Information element category	Information elements	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE	
	Message Type		M	M		
CN information elements	NAS binding info		M	M	Transparent non access stratum info e.g. bearer identity.	
UE Information elements	Activation time		O	O		
	C-RNTI		O	O	Only RACH/FACH	
RAB information elements	RAB identity		M	M	For the new RAB	
	RLC info		M	M		
	RAB multiplexing info		M	M		
	RAB identity		O	O	For each other RAB affected by this message	
	RAB multiplexing info		O	O		
TrCH information elements	TFCS		O	O	for uplink DCHs	
	TFCS		O	O	for downlink DCHs	
	TFC subset		O	O	for DCHs in uplink	
	Transport channel identity		O	O	For each removed transport channel	Uplink transport channels
	Transport channel identity		O	O	For each reconfigured or added transport channel	
	TFS		O	O		
	Dynamic Control		O	O	For each reconfigured or added transport channel, controlled by DRAC	
	Transmission time validity		O	O		
	Time duration before retry		O	O		
	Silent period duration before release		O	O		
	Transport channel identity		O	O	For each removed (FFS) transport channel	Downlink transport channels
	Transport channel identity		O	O	For each reconfigured or added transport channel	
	TFS		O	O		
PhyCH information elements	Uplink DPCH power control info		O	O		
	Frequency info		O	O		
	Uplink DPCH info		O	O	Maximum one of these	Uplink radio resources
	PRACH info		O	O		
	~~Uplink timeslot info~~			~~O~~		
	Primary CCPCH info		O	O	For each radio link	Downlink radio resources
	Downlink DPCH info		O	O		
	Secondary CCPCH info		O	O		
	~~Downlink timeslot info~~			~~O~~	~~Note 1~~	
	SSDT indicator		O	O	Necessity is FFS	
	Gated Transmission Control info		O	O	FFS	

~~Note 1: It is assumed that the DL timeslot configuration is the same for all radio links, whether or not macro-diversity is supported for TDD.~~

10.1.5.9 TRANSPORT CHANNEL RECONFIGURATION

This message is used by UTRAN to configure the transport channel of a UE. This also includes a possible reconfiguration of physical channels. The message can also be used to assign a TFC subset and reconfigure physical channel.
RLC-SAP: t.b.d.
Logical channel: DCCH
Direction: UTRAN $\rightarrow$ UE

Information element category	Information elements	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE	
	Message Type		M	M		
UE Information elements	Activation time		O	O		
	C-RNTI		O	O	Only RACH/FACH	
	Control-only-state-timer		O	O	FFS	
TrCH information elements	TFCS		O	O	for uplink DCHs	
	TFCS		O	O	for downlink DCHs	
	TFC subset		O	O	for DCHs in uplink	
	Transport channel identity		O	O	For each reconfigured transport channel	Uplink transport channels
	TFS		O	O		
	Dynamic Control		O	O	For each reconfigured transport channel, controlled by DRAC	
	Transmission time validity		O	O		
	Time duration before retry		O	O		
	Silent period duration before release		O	O		
	Transport channel identity		O	O	For each reconfigured transport channel	Downlink transport channels
	TFS		O	O		
PhyCH information elements	Uplink DPCH power control info		O	O		
	Frequency info		O	O		
	Uplink DPCH info		O	O	Maximum one of these	Uplink radio resources
	PRACH info		O	O		
	~~Uplink timeslot info~~			~~O~~		
	Primary CCPCH info		O	O	For each radio link	Downlink radio resources
	Downlink DPCH info		O	O		
	Secondary CCPCH info		O	O		
	~~Downlink timeslot info~~			~~O~~	~~Note 1~~	
	SSDT indicator		O	O	Necessity is FFS	
	Gated Transmission Control info		O	O	FFS	

~~Note 1: It is assumed that the DL timeslot configuration is the same for all radio links, whether or not macro-diversity is supported for TDD.~~

Proposed Changes to the RRC Protocol Specification (25.331) for additional TDD specific IE's and parmeters:

10.1.6 System Information Messages
10.1.6.1 SYSTEM INFORMATION

<Functional description of this message to be included here>
RLC-SAP: t.b.d.
Logical channel: BCCH or DCCH or CCCH
Direction: UTRAN → UE

NOTE: The division of the system information into messages is FFS.

Information element category	Information elements	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE	
	Message Type		M	M		
CN information elements	PLMN Identity		M	M		
	CN domain identity		M	M		For each Core Network Domain. Information must be included for at least one core network domain type.
	NAS system information		M	M		
UTRAN mobility information elements	URA identity		M	M		For each URA
	Information for periodic cell and URA update		M	M		*Note: not for each URA any more*
	Cell identity		M	M	The necessity and usage of cell identity is FFS.	
	Cell selection and re-selection info		M	M		
UE information elements	Uplink access control info		M	M		
	Transmission probability		O	O	For all UE having DCH controlled by DRAC procedure	For each class of UE Note2
	Maximum bit rate		O	O		
PhyCH information elements	Frequency info		O	O	For each RACH	
	PRACH info		M	M		
	Cell Sync Info		M		Identification of TDD cell synchronisation case (k)	
	Neighbouring Cell Info		M		Neighbouring TDD cell synchronisation and broadcast channel information	
	Frequency info		O	O	For each FACH on secondary CCPCH	
	Secondary CCPCH info		M	M		
	Frequency info		O	O	For each PCH on secondary CCPCH	
	Secondary CCPCH info		M	M		
	PRACH power control info		M	M		

Measurement Information elements	Measurement Identity Number		M	M	Note 1	For each Intra-frequency measurement control
	Intra-frequency cell info		M	M	For each measurement object	
	Intra-frequency measurement quantity		M	M		
	Intra-frequency measurement reporting criteria		M	M		
	Measurement Identity Number		M	M	Note 1	For each Inter-frequency measurement control
	Inter-frequency cell info		M	M	For each measurement object	
	Inter-frequency measurement quantity		M	M		
	Inter-frequency measurement reporting criteria		M	M		
	Measurement Identity Number		M	M	Note 1	For each Inter-system measurement control
	Inter-system cell info		M	M	For each measurement object	
	Inter-system measurement quantity		M	M		
	Inter-system measurement reporting criteria		M	M		

Note 1: The necessity and usage of Measurement identity number in this message is FFS.

Note 2: The split of parameters into several System Information message X is FFS.

10.2.6 Physical CH Information elements

10.2.6.3 Secondary CCPCH info

Parameters	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE
DL scrambling code		N/A	O	Only needed if different from DL scrambling code of Primary CCPCH
Channelization code		M	M	
Time Slot		M	N/A	

10.2.6.4 PRACH info

Parameters	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE
Access slot		N/A	M	For each allowed access slot for the preambles
Preamble spreading code		N/A	M	For each code to use for spreading of the preamble. There is also a one to one mapping from preamble code to what scrambling code to use for the message part.
Preamble signature		N/A	M	For each allowed preamble signature.
Spreading factor		N/A	M	For each rate or SF that are allowed to use on the data part (I-branch) in the message part of the random access
Time Slot		M	N/A	For each RACH in TDD mode
Channelization Code		M		

10.2.6.6 Uplink DPCH info

Parameters	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE	
UL scrambling code		M	M	What short or long uplink scrambling code a certain UE should use	
DPCCH channelization code		N/A	M	SF of the channelization code for control part. *[The necessity of this parameter is FFS.]*	
DPDCH channelization code		M	M	SF of the channelization code for data part	For each DPDCH
Time Slot		M	N/A	Time slots to be used in the UL for TDD	
Spreading Factor(SF)		M		SF to be used in the DL for TDD mode	

10.2.6.8 Downlink DPCH info

Parameters	REFERENCE	TYPE (TDD)	TYPE (FDD)	NOTE	
DL scrambling code		O	O	Only needed if different from DL scrambling code of Primary CCPCH	
DL channelization code		M	M	Channelization codes to be used in the downlink for DPCH	For each DPCH
Time Slot		M	N/A	Time slots to be used in the DL for TDD	
Spreading Factor (SF)		M		SF to be used in the DL for TDD	

~~10.2.6.9 Uplink timeslot info (TDD only)~~

~~Parameters~~	~~REFERENCE~~	~~TYPE~~	~~NOTE~~	
~~Slot number~~		~~M~~	~~Timeslot to be used in uplink (TDD only)~~	~~For each slot~~

~~10.2.6.10 Downlink timeslot info (TDD only)~~

~~Parameters~~	~~REFERENCE~~	~~TYPE~~	~~NOTE~~	
~~Slot number~~		~~M~~	~~Timeslot to be used in downlink (TDD only)~~	~~For each slot~~

10.2.6.10 Neighboring Cell Sync Info (TDD only)

Parameters	REFERENCE	TYPE	NOTE
Cell Parameters id		M	For the cell parameter table
Sync Time Slot		M	The value K
Sync Case		M	Case 1, 2, or 3