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Agenda item:

Source: Ericsson

Title: Proposed updates to TR 25.926

Document for: Decision

This contribution proposes some updates to the TR 25.926 "UE Radio Access Capabilities".

Transport channel parameters in the downlink.

The current capability ***"Maximum sum of number of bits of all transport blocks received in TTIs that end at the same time"*** does not take into account that downlink common and dedicated transport channel may not be frame aligned. Therefore it is proposed that this capability should be changed to ***"Maximum sum of number of bits of all transport blocks recieved in TTIs that end within the same arbitrary interval of length T<10 ms"***

It is also proposed that this parameter is extended with two related capabilities covering only convolutional coded and turbo coded transport channels respectively, i.e. ***"Maximum sum of number of bits of all convolutionally coded transport blocks recieved in TTIs that end within the same arbitrary interval of length T<10 ms"*** and ***"Maximum sum of number of bits of all turbo coded transport blocks recieved in TTIs that end within the same arbitrary interval of length T<10 ms"***

A UE can only be requried to receive transport-channel combinations that are within the range of all three capabilities above. The possible values for these three capabilities is proposed to be the same as the possible values for the current capability ***"Maximum sum of number of bits of all transport blocks received in TTIs that end at the same time"***.

At WG1 #10, some problems with the capability ***"Maximum sum of number of sustainedly processable bits of all transport blocks received in TTIs that end at the same time, normalized with the respective TTI length in number of radio frames***" were discovered. We therefore propose that this capability is removed.

Transport channel parameters in the uplink

It is proposed that the capability ***"Maximum sum of number of all transport blocks transmitted in TTIs that start at the same time"*** is extended with two related capabilities covering only convolutional coded and turbo coded transport channels respectively, i.e. ***"Maximum sum of number of all convolutionally coded transport blocks transmitted in TTIs that start at the same time"*** and ***"Maximum sum of number of all turbo coded transport blocks transmitted in TTIs that start at the same time"***

A UE can only be requried to transport transport-channel combinations that are within the range of all three capabilities above. The possible values for the two later capabilities is proposed to be the same as the possible values for the current capability ***"Maximum sum of number of bits of all transport blocks transmitted in TTIs that end at the same time"***.

Also, similar to the uplink, it is proposed that the capability ***"Maximum sum of number of sustainedly processable bits of all transport blocks received in TTIs that end at the same time, normalized with the respective TTI length in number of radio frames"*** is removed.

FDD Physical channel parameters in downlink

It is proposed that

- the capability ***"Maximum number of DPDCH per RL"*** is replaced by ***"Maximum number of DPCH/PDSCH to be simultaneously received"***

- the capability ***"Maximum number of DPCH bits received per 10 ms"*** is proposed to be replaced by ***"Maximum number of physical-channel bits received in any 10 ms interval (DPCH, PDSCH, S-CCPCH)"***
- the capability ***"Maximum number of simultaneous S-CCPCH"*** is removed, as more than one S-CCPCH should never be needed to be received.
- The capability ***"Simultaneous reception of S-CCPCH and DPCH" is relaplaced by "Simultaneous reception of S-CCPCH and DPCH/PDSCH"***

The proposed updates are illustrated in more detail below.

4 UE radio access capability parameters

NOTE: In this chapter all UE radio access capability parameters will be defined. The selection of parameters will be based on UE implementation constraints and not on RAB constraints. For each parameter the relation to configuration parameters (from the RRC specification) will be shown.

In the following the UE radio capability parameters are defined. In addition the relevant RRC configuration parameters are shown when applicable. When using the RRC configuration parameters, UTRAN needs to respect the UE capabilities. Only parameters for which there is a need to set different values for different UEs are considered as UE capability parameters. Therefore, the capabilities that are the same for all UEs, including baseline capabilities, are not listed here.

UTRAN is responsible for the respect of the UE capabilities when configuring the RBs. Actions in the UE when capabilties are in conflict with a UTRAN request are specified in RRC.

4.1 PDCP parameters

Header compression algorithm supported

Defines whether header compression algorithms will be supported by the UE. If it will be supported it will be the RFC 2507 as specified in TS 25.323.

4.2 BMC parameters

No UE radio access capability parameters identified

4.3 RLC parameters

NOTE: It is FFS whether some of the RLC functions should be considered as UE capabilities.

Total RLC AM buffer size

The total buffer size across all RLC AM entities puts requirements on memory.

UTRAN controls that the UE capability can be fulfilled through the following parameters:

1. The number of RLC AM entities configured (no explicit RRC parameter)
2. UL PU size
3. Transmission window size (#PUs)
4. Receiving window size (FFS whether this is configurable)

The following criterion must be fulfilled in the configuration:

$$\sum_{i=1}^{\#RLC\_AM\_entities} Transmission\_window\_size_i \bullet UL\_PU\_size_i + \sum_{i=1}^{\#RLC\_AM\_entities} Receiving\_window\_size_i \bullet DL\_PU\_size_i \leq Total\_RLC\_buffer\_size$$

where *i* is the RLC "entity number"

Maximum number of AM entities

The number of AM entities affect the main part of the total processing and memory capacity to be shared between different RLC machines.

4.4 MAC parameters

No capability parameters identified.

4.5 PHY parameters

NOTE: It is FFS whether some of the parameters need to be separate for different physical channel types. Furthermore, some of the parameters that are currently separted between uplink and downlink will be merged if it shows that the appropriate values are the same in uplink and downlink.

4.5.1 Transport channel parameters in downlink

Maximum sum of number of bits of all transport blocks received in TTIs that end within the same arbitrary interval of length T<10 ms.

This parameter is defined as

$\Sigma_i(N_i)$

where N_i is defined as the number of bits in transport block #i, and the sum is over all transport blocks received in TTIs that end within the same 10 ms interval. All transport blocks that are to be simultaneously received by the UE on DCH, FACH, PCH and DSCH transport channels are included in the parameter.

A UE does not need to support a TFC within the TFCS for which the sum of *Number of Transport Blocks * Transport Block size* over all simultaneous transport channels is larger than what the UE capability indicates.

Maximum sum of number of bits of all convolutionally coded transport blocks received in TTIs that end within the same arbitrary interval of length T<10 ms.

This parameter is defined similar to the parameter above, but the sum includes only convolutionally coded transport blocks.

Maximum sum of number of bits of all turbo coded transport blocks received in TTIs that end within the same arbitrary interval of length T<10 ms.

This parameter is defined similar to the parameter above, but the sum includes only turbo coded transport blocks.

Maximum number of simultaneous transport channels

This is defined as the maximum number of Transport Channels that should be possible to process simultaneously, not taking into account the rate of each Transport Channel.

The number of simultaneous transport channels affects how the total memory space and processing capacity can be shared among the transport channels.

A UE does not need to support more simultaneous transport channels than the UE capability allows for.

NOTE: It is FFS whether the maximum number of TrChs per CCTrCH should be included.

Maximum number of simultaneous CCTrCH

For FDD CCTrCH should be interpreted as CCTrCH of DCH type, i.e. a CCTrCH consisting of one or several DCH. Simultaneous reception of CCTrCH of DCH type with CCTrCH of not-DCH type (DSCH, FACH, and/or PCH) is covered by other capabilities (PDSCH support and support for simultaenous reception of DPCH and S-CCPCH).

For TDD the CCTrCH should be interpreted as CCTrCH of any type, i.e. consisting of DCH, FACH or DSCH.

Maximum total number of transport blocks received within TTIs that end within the same 10 ms interval

All transport blocks that are to be simultaneously received by the UE on DCH, FACH, PCH and DSCH transport channels are included in the parameter.

Relates to processing requirements for CRC in downlink.

A UE does not need to support a TFC within the TFCS for which the sum of *Number of Transport Blocks* is larger than what the UE capability indicates.

Maximum number of TFC in the TFCS

The maximum number of TFC in a TFCS sets the size of the TFCI to TFCS mapping table to be handled by the UE.

Support for turbo decoding

Defines whether turbo decoding is supported or not

The UTRAN configuration parameter is *Type of channel coding* which is part of the Transport format set (TFS) of each transport channel.

Support of 24 bits CRC

Defines whether 24 bits CRC is supported or not. CRC lengths of 0, 8, 12 and 16 bits shall be mandatory for all UEs.

UTRAN configures the CRC size through the parameter *CRC size*, which is part of the *Transport format set*.

NOTE: It is unclear whether 24 bits CRC is needed for PCH. In that case it will be mandatory for all UEs, and the capability parameter will be removed.

4.5.2 Transport channel parameters in uplink

Maximum sum of number of bits of all transport blocks transmitted in TTIs that start at the same time

This parameter is defined as

$\Sigma_i(N_i)$

where N_i is defined as the number of bits in transport block #i, and the sum is over all transport blocks received in TTIs that end at the same time

This parameter is related to memory requirements for uplink data received from MAC before it can be transmitted over the radio interface. As shown in Figure 2 the worst case occurs for the maximum TTI.

A UE does not need to support a TFC within the TFCS for which the sum of *Number of Transport Blocks* * *Transport Block size* over all simultaneous transport channels is larger than what the UE capability indicates.

Maximum sum of number of bits of all convolutionally coded transport blocks transmitted in TTIs that start at the same time

This parameter is defined similar to the parameter above, but the sum includes only convolutionally coded transport blocks.

Maximum sum of number of bits of all turbo coded transport blocks transmitted in TTIs that start at the same time

This parameter is defined similar to the parameter above, but the sum includes only turbo coded transport blocks.

Maximum number of simultaneous transport channels

The number of simultaneous transport channels affects how the total memory space and processing capacity can be shared among the transport channels.

UTRAN shall not set up more simultaneous transport channels than the UE capability allows for.

Maximum number of simultaneous CCTrCH

TDD only. For FDD there is always only one CCTrCH at a time.

Maximum total number of transport blocks transmitted within TTIs that start at the same time

Relates to processing requirements for CRC in uplink.

A UE does not need to support the TFC within the TFCS for which the sum of *Number of Transport Blocks* is larger than what the UE capability allows for.

Maximum number of TFC in the TFCS

The maximum number of TFC in a TFCS sets the size of the TFCI to TFCS mapping table to be handled by the UE.

Support for turbo encoding

Defines whether turbo encoding is supported or not

The UTRAN configuration parameter is *Type of channel coding* which is part of the Transport format set (TFS) of each transport channel.

Support of 24 bits CRC

Defines whether 24 bits CRC is supported or not. CRC lengths of 0, 8, 12 and 16 bits shall be mandatory for all UEs.

UTRAN configures the CRC size through the parameter *CRC size*, which is part of the *Transport format set*.

NOTE: It is unclear whether 24 bits CRC is needed for PCH. In that case it will be mandatory for all UEs, and the capability parameter will be removed.

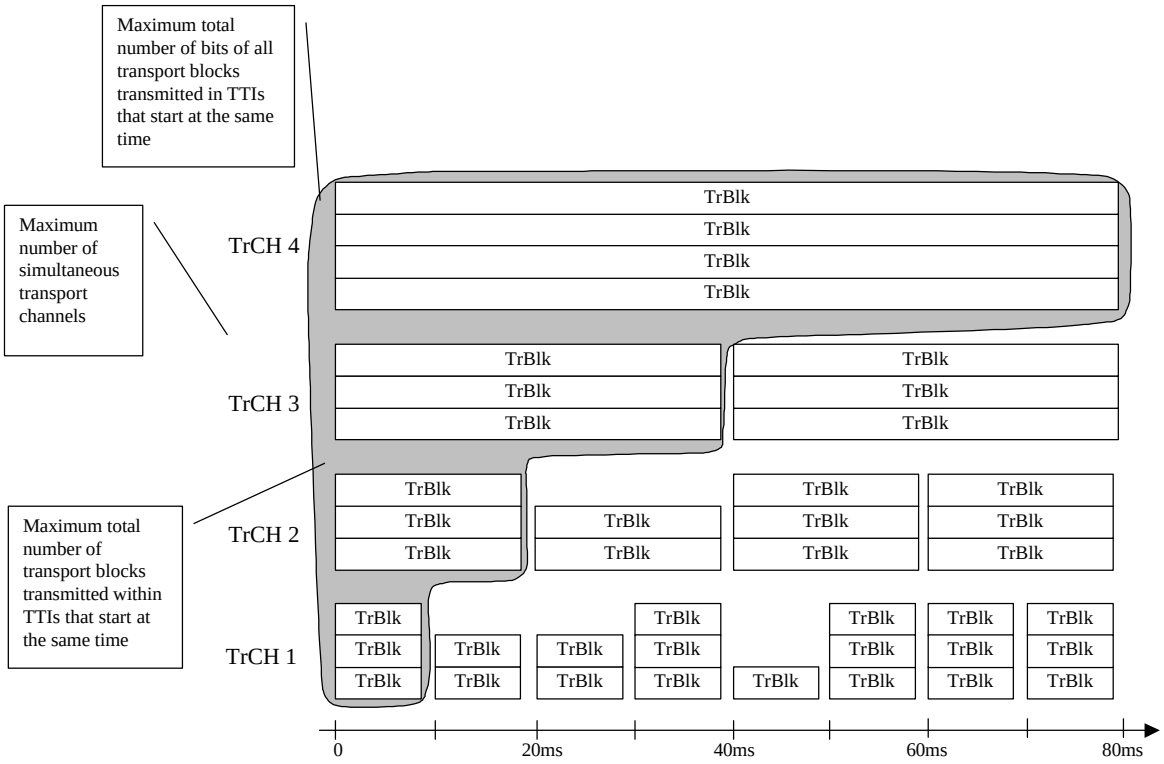

Figure 2: UE transport channel processing limitations in uplink

4.5.3 FDD Physical channel parameters in downlink

Maximum number of DPCH/PDSCH to be simultaneously received

Defines the number of codes the UE is capable of receiving in parallel. For DPCH in soft/softer handover, each DPCH is only calculated once in this capability. The capability does not include codes used for S-CCPCH.

Maximum number of physical channel bits received in any 10 ms interval (DPCH, PDSCH, S-CCPCH)

Defines the number of physical channel bits the UE is capable of receiving. For DPCH in soft/softer handover, each DPCH is only calculated once in this capability.

The number of DPCH channel bits indicates the capability for normal, un-compressed mode.

Support for SF 512

Spreading factor 512 should not be mandatory for all UEs.

The corresponding configuration parameter is *Spreading factor* which is part of *Downlink DPCH info*.

Support of PDSCH

Support of PDSCH is only required for some RAB realisations, and is therefore a UE capability.

The corresponding configuration parameter is *Downlink transport channel type* which is part of *RB mapping info*.

Simultaneous reception of SCCPCH and DPCH/PDSCH

Simultaneous reception of SCCPCH and DPCH/PDSCH, i.e. simultaneous reception of FACH and DCH/DSCH is required for e.g. DRAC procedure, but it should not be mandatory for all UEs (e.g. speech only UEs). The PDSCH part of this capability is only relevant if the UE supports PDSCH, as covered by the capability "Support of PDSCH".

NOTE: It is FFS how this parameter is related to Maximum number of DPCH per RL.

There is no specific configuration parameter.

4.5.4 FDD physical channel parameters in uplink

Maximum number of DPDCH bits per 10 ms

This capability combines the 'Max number of DPDCH' and 'Minimum SF' capabilities into one capability. Note that no flexibility is lost due to this, as multiple DPDCH is only used for SF=4, i.e. when the number of DPDCH bits exceed a certain value.

Support of PCPCH

Support of PCPCH is only required for some RAB realisations, and is therefore a UE capability.

There is no specific configuration parameter.

4.5.5 TDD physical channel parameters in downlink

Maximum number of timeslots per frame

Defines the maximum number of timeslots per frame that the UE can receive.

Maximum number of physical channels per frame

This parameter defines how many physical channels can be received during one frame. The distribution of the received physical channels on the received timeslots can be arbitrary.

Minimum SF

Defines the minimum SF supported by the UE.

Support of PDSCH

Defines whether PDSCH is supported or not.

4.5.6 TDD physical channel parameters in uplink

Maximum Number of timeslots per frame

Defines the maximum number of timeslots per frame that the UE can transmit.

Maximum number of physical channels per timeslot

Defines the maximum number physical channels transmitted in parallel during one timeslot.

Minimum SF

Defines the minimum SF supported by the UE.

Support of PUSCH

Defines whether PUSCH is supported or not.

4.5.7 RF parameters

UE power class

The value is fixed per UE and is not related to any configuration parameter.

Radio frequency bands

Defines the uplink and downlink frequency bands supported by the UE.

Configuration parameters are *UTRA RF Channel numbers* for uplink and downlink which are part of *Frequency info*.

Tx/Rx frequency separation

Defines the uplink/downlink frequency separations supported by the UE.

Configuration parameters are *UTRA RF Channel numbers* for uplink and downlink which are part of *Frequency info*.

Chip rate capability

Chip rates supported by the UE.

Corresponding configuration parameter is *chip rate* which is part of *Frequency info.*

4.6 Multi-mode related parameters

Support of UTRA FDD/TDD

Defines whether UTRA FDD and/or TDD are supported.

There is no explicit configuration parameter.

4.7 Multi-RAT related parameters

Support of GSM

Defines whether GSM is supported or not.

There is no explicit configuration parameter.

Support of multi-carrier

Defines whether multi-carrier is supported or not.

There is no explicit configuration parameter.

4.8 LCS related parameters

LCS support

Defines the positioning methods supported..

NOTE: This necessity of this parameter and the value range depends on the decision on which (and how many) positioning methods will be mandatory or optional for the UE.

There is no explicit configuration parameter.

4.9 Measurement related capabilities

Uplink compressed mode

Defines whether the UE supports an independent use of compressed mode in uplink and downlink.

5 Possible UE radio access capability parameter settings

5.1 Value ranges

The value ranges are, depending on the particular parameter, specified according to either on of the following alternatives.

1. Value range: Yes/No (support or not support)
2. Value range: MIN, GRANULARITY, MAX

   minimum value for providing the baseline capability

   granularity

   maximum value should be defined so that a wide variety of UE's (with different capabilities) can exist in the future.
3. Some distinctive values between **minimum value** and **maximum value**, not necessarily with a linear granularity.

NOTE: It has been suggested to leave the maximum value open whenever possible (number of bits in the information element of UE Radio Access Capability message could set the upper bound)

Table 1: UE radio access capability parameter value ranges

		UE radio access capability parameter	Value range
PDCP parameters		Header compression algorithm supported	Yes/No
RLC parameters		Total RLC AM buffer size	2,10,50,100,150,500,1000 kBytes
		Maximum number of AM entities	2,3,4,8,16,32
PHY parameters	Transport channel parameters in downlink	Maximum sum of number of bits of all transport blocks received in TTIs that end within the same arbitrary interval of length T<10 ms	640, 1280, 2560, 3840, 5120, 6400, 7680, 8960, 10240, 20480, 40960, 81920, 163840
		Maximum sum of number of bits of all convolutionally coded transport blocks received in TTIs that end within the same arbitrary interval of length T<10 ms	640, 1280, 2560, 3840, 5120, 6400, 7680, 8960, 10240, 20480, 40960, 81920, 163840
		Maximum sum of number of bits of all turbo coded transport blocks received in TTIs that end within the same arbitrary interval of length T<10 ms	640, 1280, 2560, 3840, 5120, 6400, 7680, 8960, 10240, 20480, 40960, 81920, 163840
		Maximum number of simultaneous transport channels	4, 8, 16, 32
		Maximum number of simultaneous CCTrCH (of DCH type	1, 2, 3, 4, 5, 6, 7, 8
		Maximum total number of transport blocks received within TTIs that end within the same 10 ms interval	4, 8, 16, 32, 48, 64, 96, 128, 256, 512
		Maximum number of TFC in the TFCS	16, 32, 48, 64, 96, 128, 256, 512, 1024
		Support for turbo decoding	Yes/No
		Support of 24 bits CRC	Yes/No
	Transport channel parameters in uplink	Maximum sum of number of bits of all transport blocks transmitted in TTIs that start at the same time	640, 1280, 2560, 3840, 5120, 6400, 7680, 8960, 10240, 20480, 40960, 81920, 163840
		Maximum sum of number of bits of all convolutionally coded transport blocks transmitted in TTIs that start at the same time	640, 1280, 2560, 3840, 5120, 6400, 7680, 8960, 10240, 20480, 40960, 81920, 163840
		Maximum sum of number of bits of all turbo coded transport blocks transmitted in TTIs that start at the same time	640, 1280, 2560, 3840, 5120, 6400, 7680, 8960, 10240, 20480, 40960, 81920, 163840
		Maximum number of simultaneous transport channels	2, 4, 8, 16, 32
		Maximum number of simultaneous CCTrCH of DCH type (TDD only)	1, 2, 3, 4, 5, 6, 7, 8
		Maximum total number of transport blocks transmitted within TTIs that start at the same time	2, 4, 8, 16, 32, 48, 64, 96, 128, 256, 512

		Maximum number of TFC in the TFCS	4, 8, 16, 32, 48, 64, 96, 128, 256, 512, 1024
		Support for turbo encoding	Yes/No
		Support of 24 bits CRC	Yes/No
	FDD Physical channel parameters in downlink	Maximum number of physical channels to be simultaneously received (DPCH, PDSCH, S-CCPCH)	1, 2, 3, 4, 5, 6, 7, 8
		Maximum number of physical channel bits received in any 10 ms interval (DPCH, PDSCH, S-CCPCH)	300, 600, 1200, 2400, 4800, 9600, 19200, 28800, 38400, 48000, 57600, 67200
		Support for SF 512	Yes/No
		Support of PDSCH	Yes/No
		Simultaneous reception of SCCPCH and DPCH	Yes/No
	FDD Physical channel parameters in uplink		
		Maximum number of DPDCH bits transmitted per 10 ms	150, 300, 600, 1200, 2400, 4800, 9600, 19200, 28800, 38400, 48000, 57600
		Support of PCPCH	FFS
	TDD physical channel parameters in downlink	Maximum number of timeslots per frame	1..14
		Maximum number of physical channels per frame	1,2,3..,224
		Minimum SF	16, 1
		Support of PDSCH	Yes/No
	TDD physical channel parameters in uplink	Maximum Number of timeslots per frame	1..14
		Maximum number of physical channels per timeslot	1, 2
		Minimum SF	16,8,4,2,1
		Support of PUSCH	Yes/No
RF parameters	FDD RF parameters	UE power class (25.101 section 6.2.1)	1, 2, 3, 4
		Radio frequency bands (25.101 section 5.2)	a), b), a+b)
		Tx/Rx frequency separation FFS for frequency band b (25.101 section 5.3)	190 MHz 174.8-205.2 MHz 134.8-245.2 MHZ
		Chip rate capability	N/A for FDD
RF parameters	TDD RF parameters	UE power class (25.102)	1,2,3,4,
		Radio frequency bands (25.102)	a), b), c), a+b), a+c), a+b+c)
		Tx/Rx frequency separation	N/A for TDD
		Chip rate capability (25.102)	3.84,1.28
Multi-mode related parameters		Support of UTRA FDD/TDD	FDD, TDD, FDD+TDD
Multi-RAT related parameters		Support of GSM	Yes/No
		Support of multi-carrier	Yes/No
LCS related parameters		LCS support	FFS
Measurement related capabilities (FFS)		Need for compressed mode	Yes/No