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methods

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Title: CR25331-x CPCH Set Info for flexible Channel Assignment

Document for: Discussion and approval

INTRODUCTION

The current CPCH access control approach allows the UE to select and request access to a particular CPCH channel defined with a fixed data rate (FRCPCH). The RNC in the Node B then either denies access or grants access to the CPCH channel selected by the UE. In recent RAN1 and RAN2 meetings, Philips and Samsung have proposed [1-4] several different means of CPCH Channel Assignment. Channel Assignment permits the RNC in Node B to direct the UE to use an alternate CPCH channel by assigning this alternate CPCH channel in a new, optional Channel Assignment (CA) message which is added to the protocol. Channel Assignment may assign fixed rate FRCPCHs and also assign new multi-rate CPCH channels (MRCPCH) to the UE. Both RAN1 and RAN2 see certain advantages in the CA approach. . This contribution proposes changes in the CPCH Set Info IE to optionally permit use of multi-rate CPCH channels with Channel Assignment.. This new CPCH Set Info description will permit FRCPCH and MRCPCH channels to be described in any combination within the CPCH set.

DISCUSSION

The current definition of FRCPCH channels in the CPCH Set Info IE defines a unique UL channelisation code for each defined CPCH channel. The length of this UL channelisation code also defines the data rate of the channel. In this way, each CPCH channel is defined at only one data rate. For flexible Channel Assignment, each MRCPCH channel may be used sequentially at different data rates. This CR adds an optional UL common multirate channelisation code to the list of parameters which apply to all MRCPCH channels in the CPCH Set Info IE. For MRCPCH channels, the individual UL channelisation codes currently listed for each CPCH channel are not needed. Instead a new UL max channel bit rate parameter is included to indicate the upper limit (if any) for this MRCPCH channel.

The following tables describe the differences between the FRCPCH and MRCPCH channels.

FRCPCH channels are defined in CPCH set by:

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1. CD and AP (and optionally CA) parameters [common to all CPCH channels]
2. UL scrambling code
3. UL channelization code (length of this code defines data rate)
4. DL channelization code
5. NF_max: max packet length in frames
6. PCP length: defines whether fixed length power control preamble is used in message part
7. Channel request parameters, consisting of:
 - AP signature code(s)
 - AP access slot subchannel(s)

MRCPCH channels are defined in CPCH set by:

1. CD, AP, and CA parameters [common to all CPCH channels]
2. UL common multirate channelisation code [common to all MRCPCH channels]
3. Data rate request parameters, consisting of:
 - data rate (to be requested with below 2 params) [common to all MRCPCH channels]
 - AP signature code(s) [common to all MRCPCH channels for this data rate]
 - AP access slot subchannel(s) [common to all MRCPCH channels for this data rate]
4. UL scrambling code
5. UL max channel bit rate
6. DL channelization code
7. NF_max: max packet length in frames
8. PCP length: defines whether fixed length power control preamble is used in message part

In the above description the UL max channel bit rate permits the UTRAN to negotiate lower data rates with the UE. This gives UTRAN more flexibility in controlling and allocating bandwidth among services. For example, if a UE requested a FRCPCH using a data rate request of 960 kbps, the UTRAN may choose to assign the FRCPCH channel which is defined with UL max channel bit rate = 240 kbps. This is a means for the UTRAN to assign FRCPCHs with lower data rates than requested by the UE.

The CPCH set info description allows FRCPCHs and MRCPCHs to be described in the same CPCH set. However, GBT's view is that it is more effective to configure resources either as:

1. A small number of FRCPCHs without CA (current approach where UE selects/UTRAN grants or denies access)
2. A larger number MRCPCHs with CA.

Due to the limit of 16 signatures per AP and 16 signature/phases per CA message, there are two constraints when configuring CPCH sets:

Due to the AP limit, the total number of AP signatures listed in all of the Data rate request parameters and all of the Channel request parameters must be less than or equal to 16. The signatures may be reused among data rate requests and the channel requests. However, if a signature/subslot combination for each request is not unique, UTRAN must send a CA to resolve the ambiguity and assign a particular CPCH channel. This flexibility permits the implementation of the Phillips proposal wherein multiple signatures may map to multiple FRCPCHs defined with the same data rate.

2. Due to the CA limit, the sum of the FRCPCH and MRCPCH channels must be less than or equal to 16.

Two example CPCH sets are described here.

Example CPCH set using 3 FRCPCH channels without Channel Assignment:

- CD and AP parameters [common to all CPCH channels]
(CA_ACTIVE parameter is NOT included)
- CPCH channel 1 info:
 - UL1 scrambling code
 - UL1 channelization code (length of this code defines data rate)
 - DL1 channelization code
 - NF_max1: max packet length in frames
 - PCP length1: defines whether fixed length power control preamble is used in message part
 - Channel 1 request parameters, consisting of:
 - AP signature code 1
 - AP access slot subchannels 0,3,6,9
- CPCH channel 2 info:
 - UL2 scrambling code
 - UL2 channelization code (length of this code defines data rate)
 - DL2 channelization code
 - NF_max2: max packet length in frames
 - PCP length2: defines whether fixed length power control preamble is used in message part
 - Channel 2 request parameters, consisting of:
 - AP signature code 1
 - AP access slot subchannels 1,4,7,10
- CPCH channel 3 info:
 - UL3 scrambling code
 - UL3 channelization code (length of this code defines data rate)
 - DL3 channelization code
 - NF_max2: max packet length in frames
 - PCP length3: defines whether fixed length power control preamble is used in message part
 - Channel 1 request parameters, consisting of:
 - AP signature code 1
 - AP access slot subchannels 2,5,8,11

This example uses only 1 AP signature for 3 CPCH channels.

Example CPCH set using 6 MRCPCH channels with Channel Assignment:

- CD and AP parameters [common to all CPCH channels]
(CA_ACTIVE parameter IS included)
- UL common multirate channelisation code [common to all MRCPCH channels]
- Data rate request parameters, consisting of:
 - 15 kbps:
 - AP signature code 1
 - AP access slot subchannels 0,4,8
 - 30 kbps:
 - AP signature code 1
 - AP access slot subchannels 1,5,9
 - 60 kbps:
 - AP signature code 1
 - AP access slot subchannels 2,6,10
 - 120 kbps:
 - AP signature code 1
 - AP access slot subchannels 3,5,11
 - 240 kbps:
 - AP signature code 2
 - AP access slot subchannels 0,4,8
 - 480 kbps:
 - AP signature code 2
 - AP access slot subchannels 1,5,9
 - 960 kbps:
 - AP signature code 2
 - AP access slot subchannels 2,6,10
- CPCH channel 1 info:
 - UL1 scrambling code
 - UL1 max channel bit rate = 240 kbps
 - DL1 channelization code
 - NF_max1: max packet length in frames
 - PCP length1: defines length of power control preamble used in message part
- CPCH channel 2 info:
 - UL2 scrambling code
 - UL2 max channel bit rate = 960 kbps
 - DL2 channelization code
 - NF_max2: max packet length in frames
 - PCP length2: defines length of power control preamble used in message part

- CPCH channel 3 info:
 - UL3 scrambling code
 - UL3 max channel bit rate = 960 kbps
 - DL3 channelization code
 - NF_max3: max packet length in frames
 - PCP length3: defines length of power control preamble used in message part
- CPCH channel 4 info:
 - UL4 scrambling code
 - UL4 max channel bit rate = 960 kbps
 - DL4 channelization code
 - NF_max4: max packet length in frames
 - PCP length4: defines length of power control preamble used in message part
- CPCH channel 5 info:
 - UL5 scrambling code
 - UL5 max channel bit rate = 960 kbps
 - DL5 channelization code
 - NF_max5: max packet length in frames
 - PCP length5: defines length of power control preamble used in message part
- CPCH channel 6 info:
 - UL6 scrambling code
 - UL6 max channel bit rate = 960 kbps
 - DL6 channelization code
 - NF_max6: max packet length in frames
 - PCP length6: defines length of power control preamble used in message part

This example uses only 2 AP signatures for 7 data rates on 6 CPCH channels. Note that the same Data rate requests using only 2 AP signatures could serve up to 16 MRCPCH channels. Also note that CPCH channel 1 has been defined with a UL max channel bit rate of 240 kbps. This will allow the UE to assign this 240 kbps channel to UEs which may request 480 kbps or higher rates.

MAPPING OF CA MESSAGES TO CPCH CHANNELS

The assumption here for use of the CD-ICH signatures/phases has not changed. The CD-ICH has 16 signatures and 2 phases for a total of 32 unique messages. 16 of these messages is used for the CD-ICH, the other 16 are used for the CA messages. The intended mapping is the one described by Phillips in a prior contribution. The CD-ICH mapping is as follows:

<u>CD-ICH -> Signature</u>	<u>acknowledges -> phase</u>	<u>CD Preamble Signature</u>
1	+	1
2	+	2
:	:	:
8	+	8
1	-	9
2	-	10
:	:	:
8	-	16
<u>CA -></u>	<u>maps to</u>	<u>CPCH channel</u>
9	+	1
10	+	2
:	:	:
16	+	8
9	-	9
10	-	10
:	:	:
16	-	16

In the above map, the CPCH channel 1 refers to the first physical CPCH channel defined in the CPCH set info message. CPCH channel 2 refers to the second CPCH defined, and so on. Up to 16 physical CPCH channels may listed in the CPCH set info.

CONCERNING USE OF PERSISTENCY VALUES

Persistency values are determined by UTRAN and serve to load balance the UE requests for CPCH resources. PV values are frequently updated and broadcast as an IE in the System Information message on the BCCH or FACH. Each Data rate request has a separate PV value. Each Channel request has a separate PV value. The PV values are transmitted in a block with the Data rate request PV values followed by the Channel request values in the same order as presented in the CPCH set info IE

CONCERNING CPCH STATUS BROADCAST

Three different kinds of CPCH status have been proposed for CPCH status broadcast on the new physical CPCH status broadcast channel. These three status types are:

1. Maximum available data rate (for MRCPCH channels)
2. Individual data rate availability (for FRCPCH channels with ambiguous channel request parameters i.e. a set of common channel request parameters which map to a group of FRCPCH channels define at the same data rate)
3. Individual channel availability (for FRCPCH channels with unique channel request parameters)

To define the structure of the CPCH status broadcast information, a new parameter is included in the CPCH set info message. This new parameter is called CPCH status broadcast mode. This mode define which status type, or combination of status types, is being broadcast on the CPCH Status Broadcast physical channel.

PROPOSAL

The following changes should be incorporated into the latest version of TS25.331, RRC Protocol. The attached CR should be approved and forwarded to RAN for incorporation.

REFERENCES

- [1] R1-99E77, "Proposal for Code Assignment in CPCH", source: Philips
- [2] R1-99F49, "Enhanced CPCH with Channel Assignment", source: Samsung
- [3] R2-99E14, "Impacts of CPCH Channel Assignment on Upper Layers", source: Samsung
- [4] R1-99F72, "Advantages of Channel Assignment for CPCH", source: Samsung