Message Sequence Charts

AS_GPRS_MSC_Measurements Document

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0.1 Document History

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0.2 References, Abbreviations, Terms

[TI 8010.801] 8010.801, "References and Abbreviations (UMTS)", Texas Instruments

Table of Contents

1 Introduction

This document is a part of the high level documentation for the dual mode GSM/GPRS and UMTS protocol stack development project. It contains a set of Message Sequence Charts (MSCs) illustrating communication between entities of the protocol stack dependent on access technology, as well as the communication from these entities to parts of the protocol stack considered independent of access technology (the Non-Access Stratum (NAS)) and to the Physical Layer (PHY).

In all MSCs entities will only be shown if they are involved in the sequence illustrated. Sub-MSCs may be used to show a sequence used in more than one context, or used repetitively. In cases where sub-MSCs are used, the sub-MSC may include more or less entities than the MSC referring to it, if some entities are only relevant to the sub-MSC or to the referring MSC.

This document is split into sections containing MSCs illustrating scenarios related to each other. The scenarios included in this document are concerned mainly with the data transfer. The meaning of each MSC should be clear of the title and the small description, in the beginning of each MSC.

2 Uplink Power Control

2.1 Parameters

The uplink power control algorithm applied by the MS is specified in the 3GPP TS 05.08.

"The RF output power, P_{CH} , to be employed by the MS on each individual uplink PDCH shall be:

$$P_{CH} = \min(\Gamma_0 - \Gamma_{CH} - \alpha * (C + 48), PMAX),$$

where

Γ_{CH}	is an MS and channel specific power control parameter, sent to the MS in an RLC control message (see 3GPP TS 04.60).
Γ_0	= 39 dBm for GSM900 = 36 dBm for DCS1800
α	is a system parameter, broadcast on PBCCH or optionally sent to MS in an RLC control message (see 3GPP TS 04.08 and 3GPP TS 04.60).
C	is the normalised received signal level at the MS as defined in 10.2.3.1.
PMAX	is the maximum allowed output power in the cell = GPRS_MS_TXPWR_MAX_CCH if PBCCH exists MS_TXPWR_MAX_CCH otherwise"

[extracted from 3GPP TS 05.08]

2.1.1 C-Value

The C-value is calculated in different ways in packet idle and packet transfer mode.

2.1.1.1 Packet Idle Mode

In packet idle mode the C-value is derived from the received signal level of the PCCCH or, if PCCCH is not existing, the BCCH.

New receive signal level measurements are provided by the L1 approximately every 1 second. Measurements are stopped on transition to packet transfer mode. When entering packet idle mode, the C-value calculation shall continue from the C-value obtained during packet transfer mode.

C-value is used for the following purposes:

- The C-value derived in packet idle mode shall be used to calculate the output power when the MS transfers its first radio block (this block could be the first block of an uplink TBF or an uplink single block.
- Packet Resource Request Message

2.1.1.2 Packet Transfer Mode

In packet transfer mode the C-value is derived from the same received signal level measurements on the BCCH carrier of the serving cell as made for cell reselection. If indicated by the parameter PC_MEAS_CHAN, the MS shall instead derive the C-value from the received signal level of each radio block on one of the PDCH monitored by the MS for PACCH.

[!!!SAB!!!] When in packet transfer mode GRLC currently uses the receive signal level measurement of the serving cell included in the MPHP_TCR_MEAS_IND primitive for cell re-selection purposes, but the receive signal level measurement provided with the function maca_power_control for deriving the C-value. This is a mismatch with specification requirement. Advice is needed.

New receive signal level measurements are provided by the L1 approximately every 20 millisecond. Measurements are started as soon as TBF starting time elapsed and stopped on transition to packet idle mode. When entering packet transfer mode, the C-value calculation shall continue from the C-value obtained during packet idle mode.

C-value is in the following RLC/MAC control messages:

- Packet Downlink Ack/Nack Message – Channel Quality Report
- Packet Resource Request Message

2.1.2 Power Control Parameters Γ_0 and α

Γ_0 and α are MS and channel specific power control parameters used to calculate the uplink output power. They are sent to the MS in the following RLC/MAC control messages:

Packet Downlink Assignment

Packet Power Control / Timing Advance

Packet System Information 1

(Packet) System Information 13

Packet Uplink Ack/Nack

Packet Uplink Assignment

Packet Timeslot Reconfigure

PDCH Assignment Command

Packet Immediate Assignment

When receiving new power control parameters the MS is required to react to it latest after a reaction time of three blocks.

2.2 Design Approach

2.2.1 C-Value

The C-value is calculated by RR in case of packet idle mode and by GRLC in case of packet transfer mode. In packet idle mode the receive signal level included either in the MPHC_DATA_IND with l2_channel equal to L2_CHANNEL_PCH or in the MPHP_DATA_IND with l2_channel equal to L2_PCHANNEL_PPCH is used for C-value calculation. In packet transfer mode the information included in the parameter of the function maca_power_control is used.

There are four different modes of operation for the C-value derivation:

- Static Packet Idle Mode

  The C-value is updated by RR every time new measured values are provided.

- Static Packet Transfer Mode

  The C-value is updated by GRLC every time new measured values are provided. Along with it, the uplink power control levels are updated.

- Transition from Packet Idle to Packet Transfer Mode

  As soon as a starting time is running (either triggered by an uplink single block procedure or by a TBF with a present starting time) any updated C-value is forwarded from RR to GRLC in order to update the uplink power control levels.

  In case no starting time is present, but a TBF request is currently processed by L1, any updated C-value is forwarded from RR to GRLC in order to update the uplink power control levels.

- Transition from Packet Transfer to Packet Idle Mode

  When leaving packet transfer mode the last obtained C-value is forwarded from GRLC to RR in order to pass control to this entity.

2.2.2 Power Control Parameters Γ_0 and α

Every RLC/MAC control message is forwarded to and decoded by RR. Decoding will be done only in RR due to timing constraint in GRLC.

In case power control parameters are included in the message they are passed back to GRLC by sending a primitive. This primitive currently does not exist when the MS is packet transfer mode and shall be defined in the CGRLC SAP. Just when changing from packet idle to packet transfer mode the primitives CGRLC_DL_TBF_REQ and CGRLC_UL_TBF_RES could be re-used by adding a specific sub-structure.

GRLC shall store the power control parameters for further processing.

When starting any uplink single block procedure (either two phase access or single block without TBF establishment) or in case a TBF with or without a present starting time is triggered by the network, the uplink power control levels shall be recalculated by GRLC any time new power control parameters are received and the starting time is not yet elapsed. L1 will retrieve the uplink power control levels by calling the function maca_power_control just at the starting time. Neither GRLC nor RR are aware of the point in time the starting time will elapsed, that's why GRLC always shall re-calculate the uplink power control levels if it receives new power control parameters.

2.2.2.1 Confirmation CGRLC_PWR_CTRL_CNF

L23 is responsible for providing correct uplink power control levels in case an uplink single block shall be sent to the network or a TBF shall be established. L1 retrieves the uplink power control level by a call to the function maca_power_control right before the uplink single block shall be sent or the TBF shall start. L23 has no control of that point in time. That's why L23 has to provide the correct power levels before requesting any uplink single block by means of the MPHP_SINGLE_BLOCK_REQ primitive or a TBF by means of the MPHP_ASSIGNMENT_REQ primitive. Just in these cases a confirmation CGRLC_PWR_CTRL_CNF is needed.

See also scenarios ‘Single Block Procedure’ and ‘TBF Establishment’ to get some more details about the applied message sequence.

2.2.2.2 L1 Access to Uplink Power Control Levels

[!!!SAB!!!] Please note that this chapter has nothing to do with the shared memory concept currently implemented in the GRLC entity. It is a general memory access violation that may occur due to the mechanism of calling a function in a primitive based system.

To avoid that L1 reads the buffer holding the uplink power control levels currently processed by GRLC (in case an uplink single block procedure is running or a TBF is going to be established or the GRLC internal signal MAC_PWR_CTRL_IND cannot be processed within 20 milliseconds), the buffer shall be hold doubled and shall be protected. The protection shall be not realised by a semaphore, but at least by using a flag which can be set in GRLC by an atomic operation. The flag determines which buffer to use by L1.

See also scenario
‘

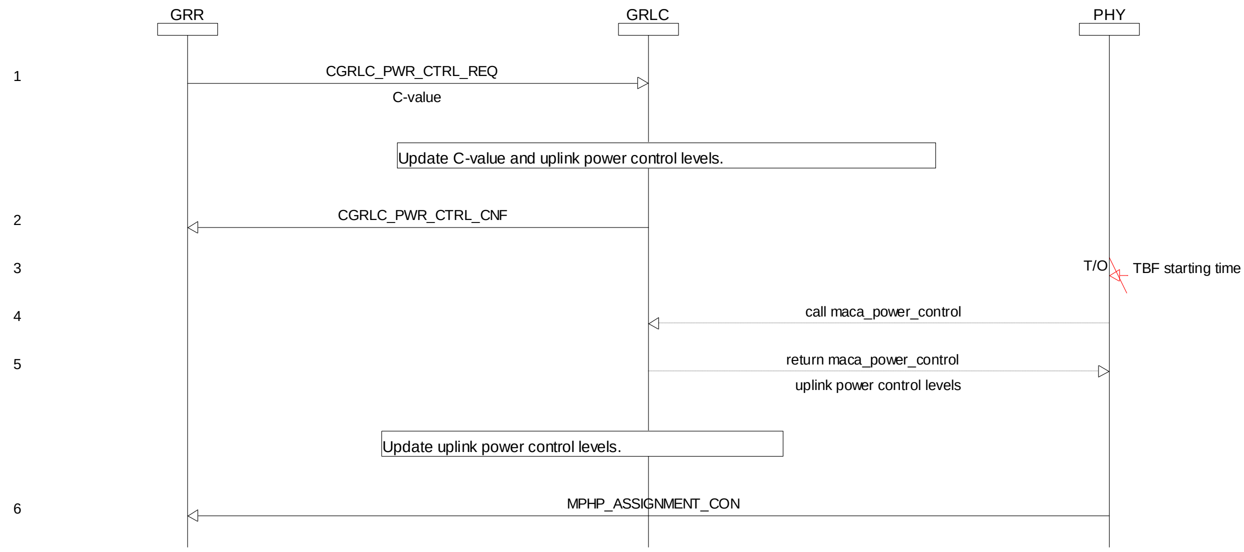

Figure 5 - TBF Establishment – Part 2

Access to Uplink Power Control Levels’ to get some more details about the applied message sequence.

2.2.3 Common Library

As the GRLC entity shall be used in several different projects any use of functions located in the common library and called from several entities possibly at the same time shall be avoided. Any direct call of functions not located in the GRLC but in other protocol stack entities shall be avoided.

2.3 Scenarios

2.3.1 Static Packet Idle Mode

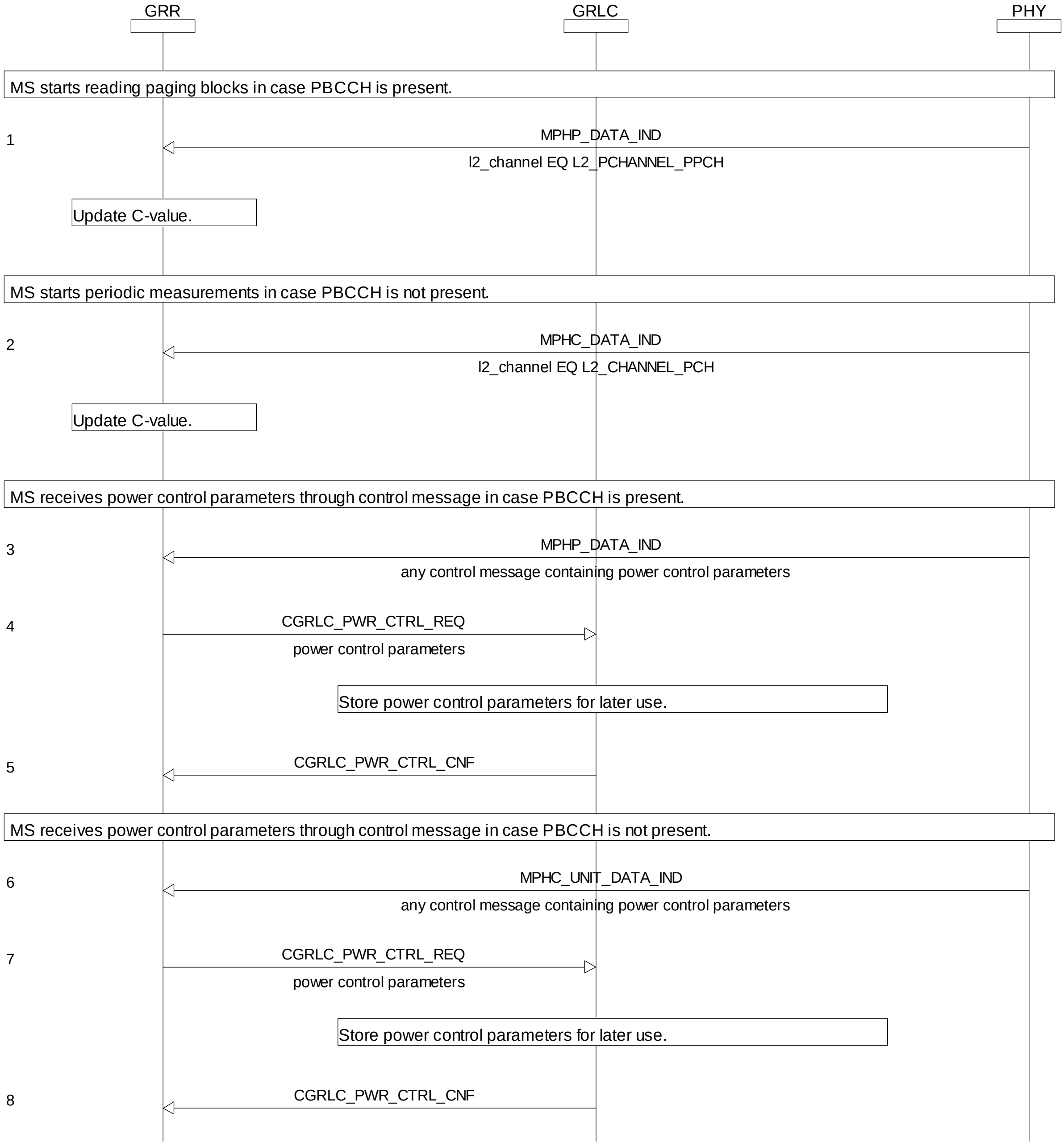

Figure 1 - Static Packet Idle Mode

2.3.2 Static Packet Transfer Mode

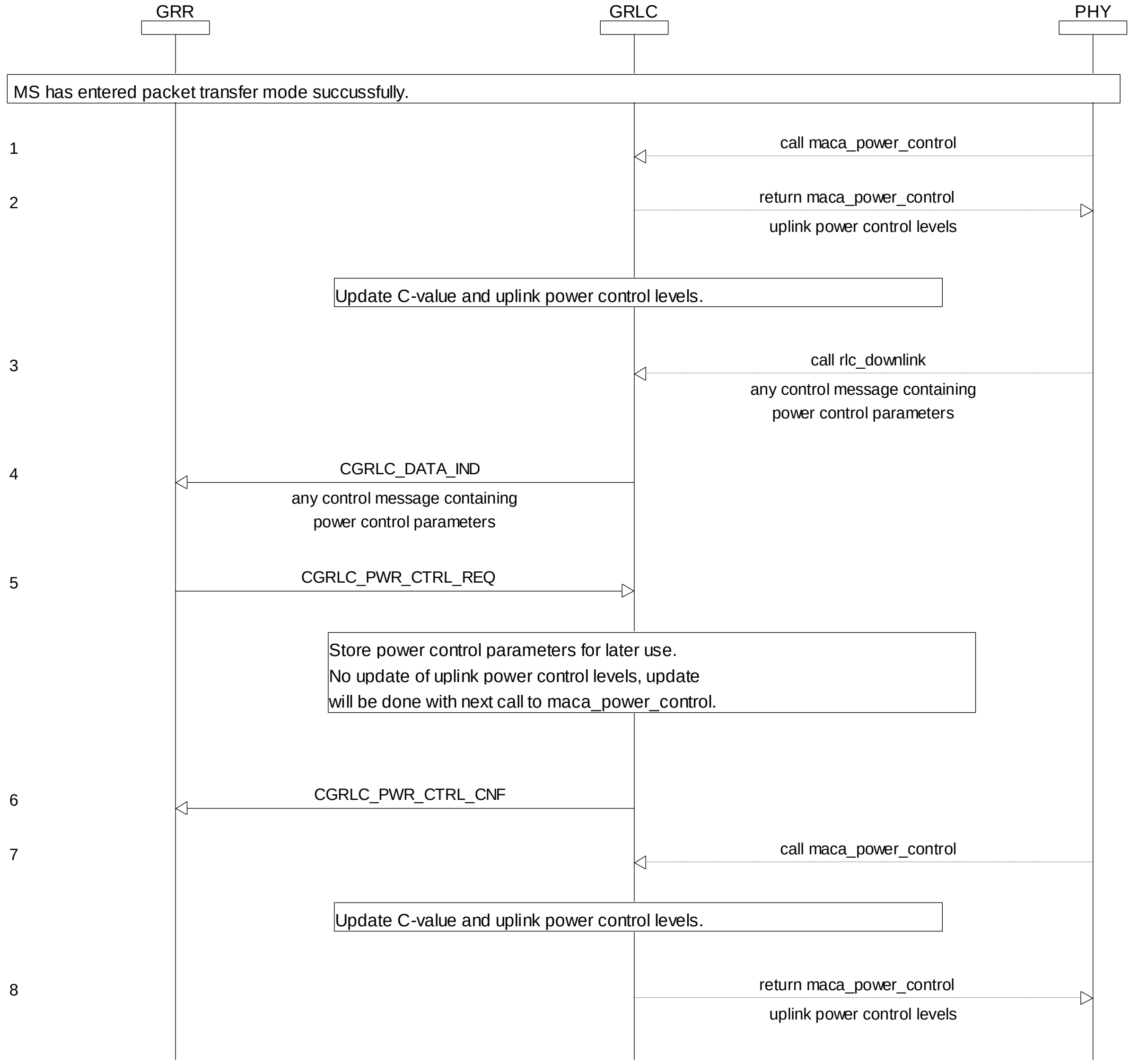

Figure 2 - Static Packet Transfer Mode

2.3.3 Transition from Packet Idle to Packet Transfer Mode

2.3.3.1 Single Block Procedure

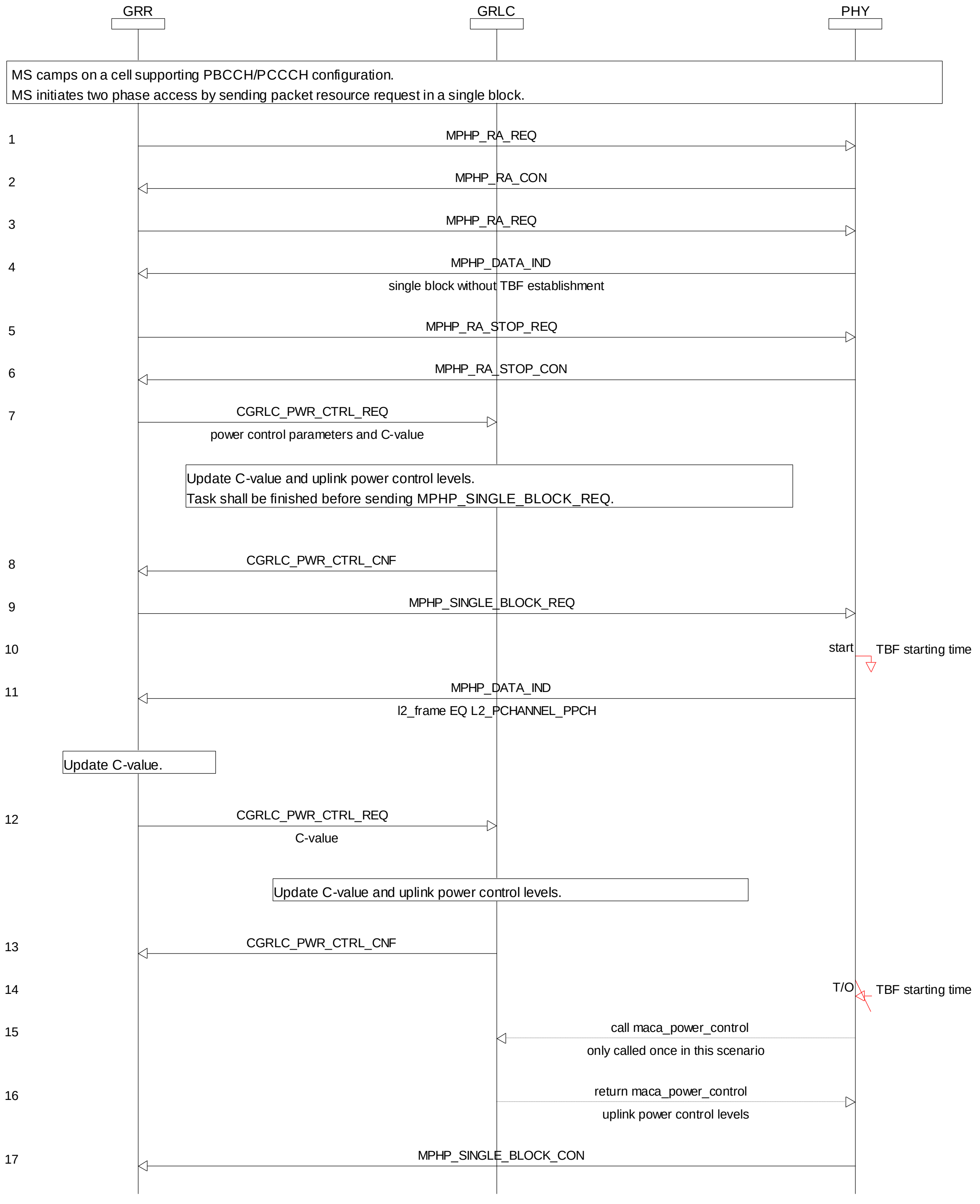

Figure 3 - Single Block Procedure

2.3.3.2 TBF Establishment

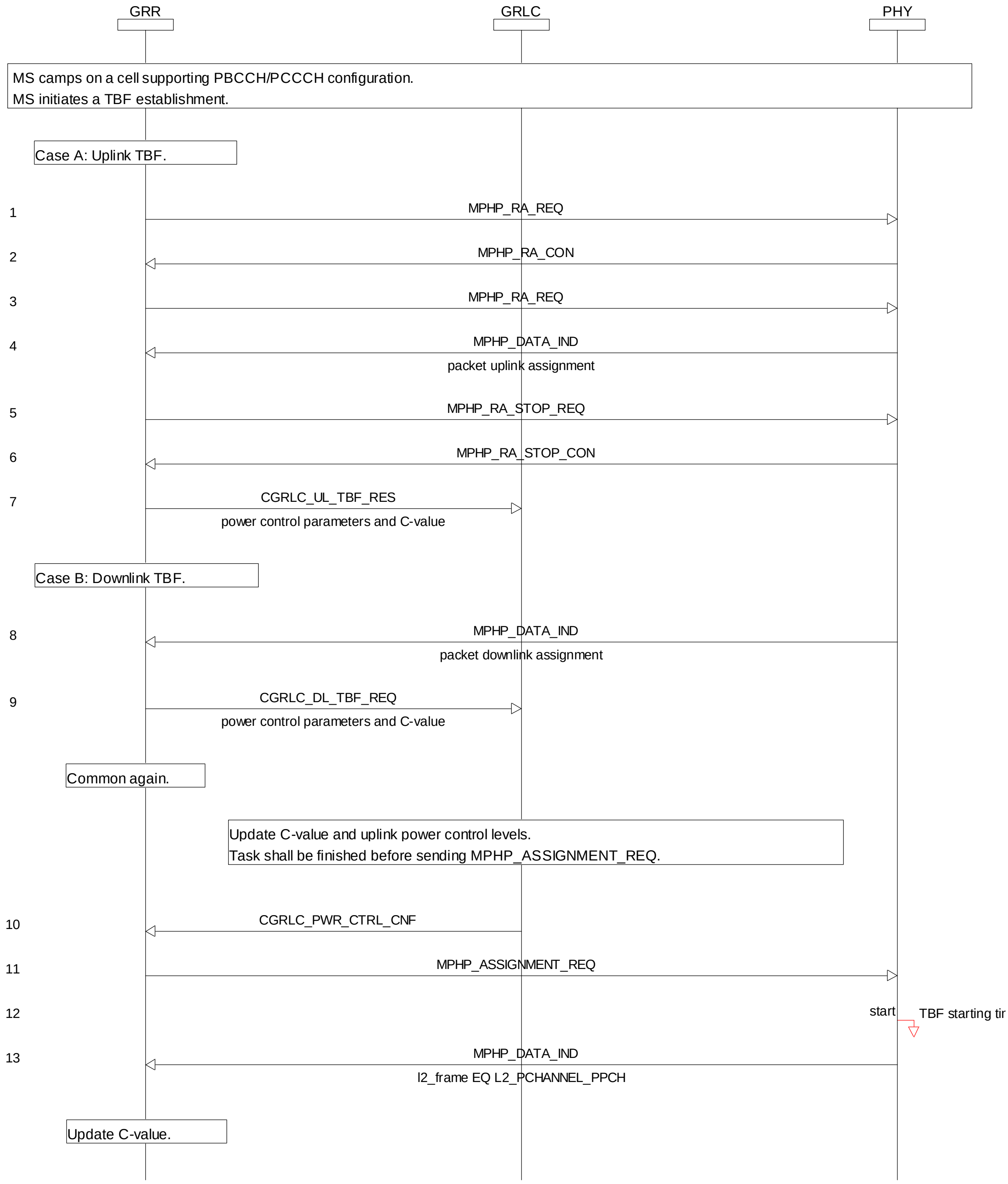

Figure 4 - TBF Establishment – Part 1

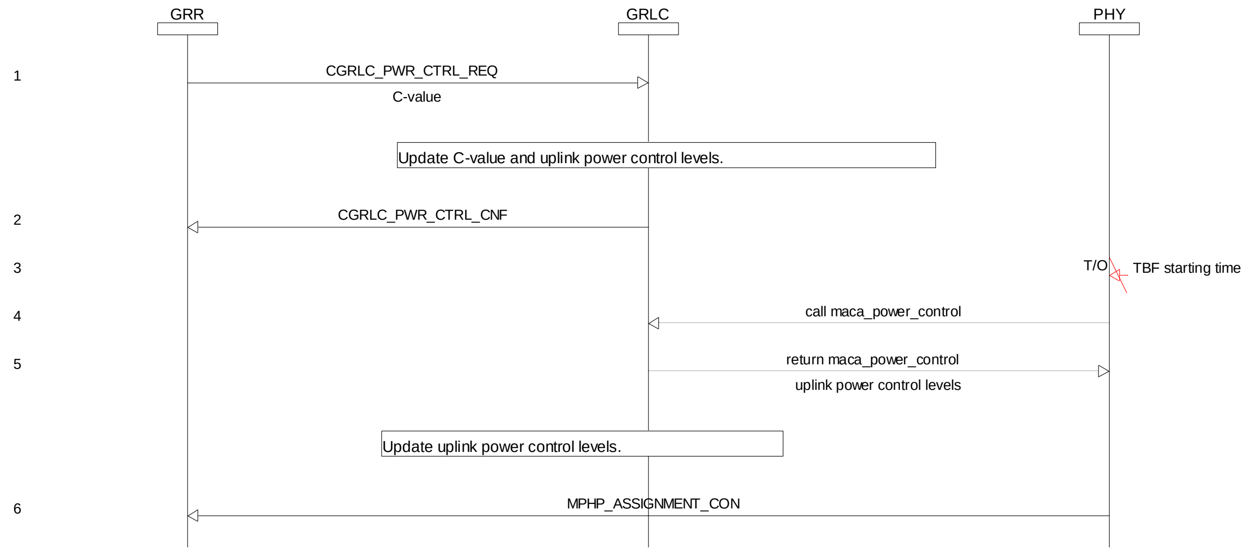

Figure 5 - TBF Establishment – Part 2

2.3.3.3 Access to Uplink Power Control Levels

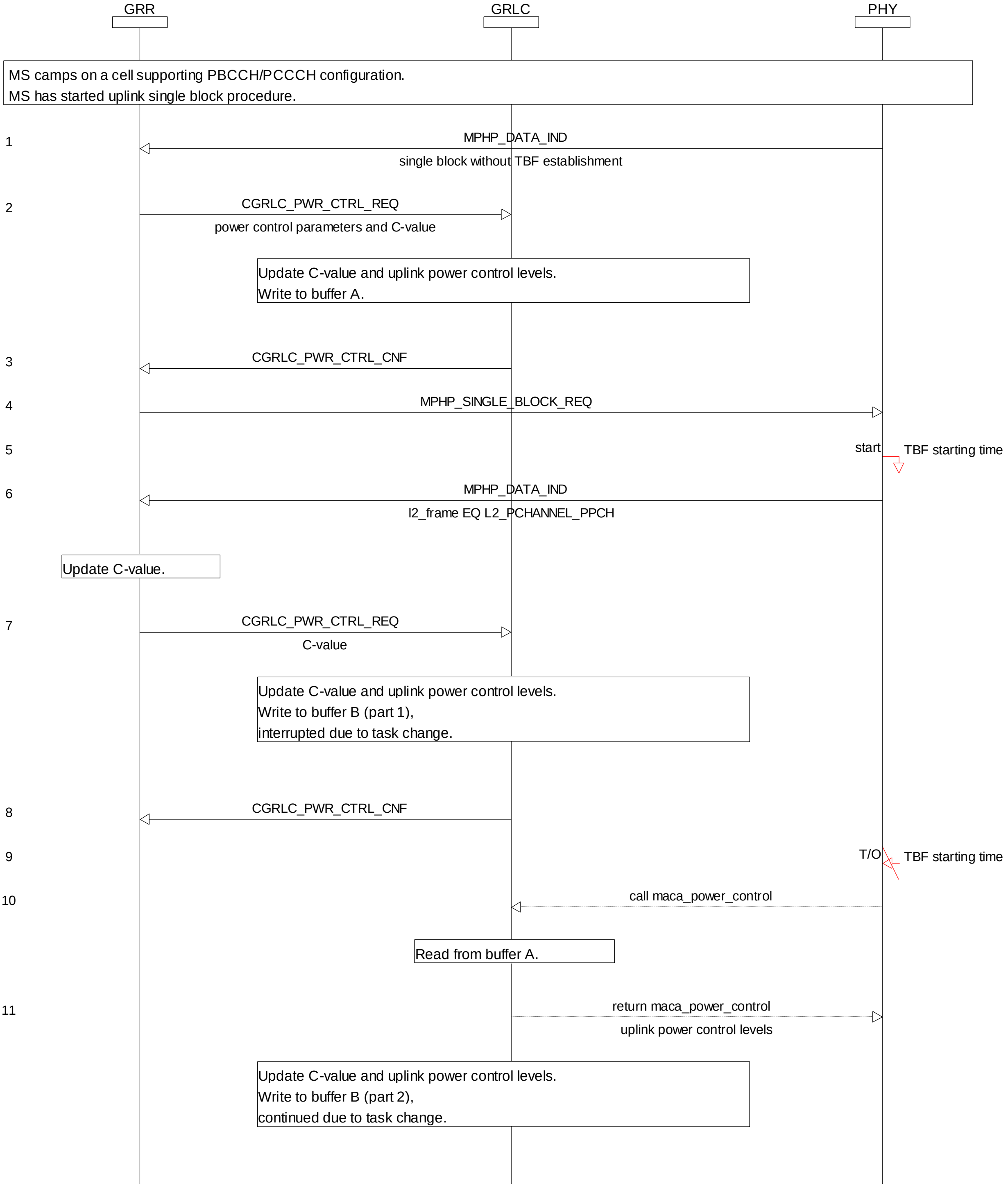

Figure 6 - Access to Uplink Power Control Levels

2.3.4 Transition from Packet Transfer to Packet Idle Mode

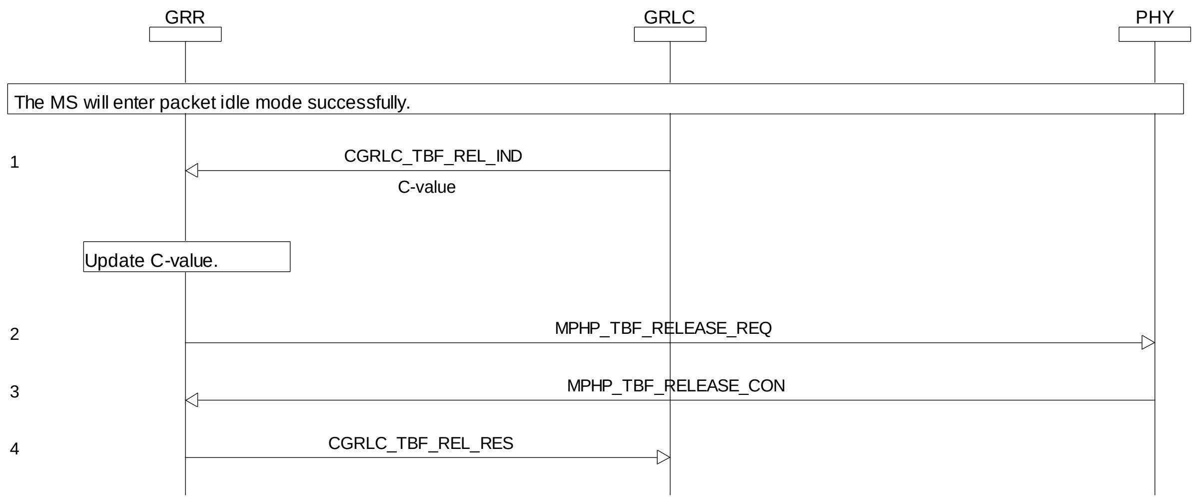

Figure 7 - Transition from Packet Transfer to Packet Idle Mode