TSG-RAN Working Group 2 (Radio layer 2 and Radio layer 3)   *TSGR2#3(99)244*
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Agenda Item: 7

Source: Siemens AG

Title: Radio Access Bearer Establishment/Release for TDD

Document for: Decision

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1 Introduction

The document summarises the Radio Access Establishment and Release Procedures needed for the TDD operation. The following message flows presuming the existence of up- and down link shared channels at least for TDD.

The described procedures have strong similarities with FDD, but we think that the differences caused by the different physical layers do not allow to have combined figures for both modes, just one example within the TDD mode DCH establishment the position of an allocated grid (defined by timeslots and codes) in the time domain is known directly after receiving the allocation message, whereas for FDD a separate synchronisation procedure is needed.

2 Radio Access Bearer Establishment

Derived from the requested QoS of the RAB the RNC-RRC can establish either a dedicated channel (DCH) or a shared channel (USCH/DSCH) association.

The case when the amount of traffic is so low that an establishment of neither a DCH nor a USCH/DSCH is appropriate and therefore the new RAB is associated to a common channel capacity is not further considered.

2.1 With Dedicated Channel Activation

Depending on the already established resources for a mobile and the new requested RAB more or less resource modifications has to be managed by the RNC-RRC:

1. a new RAB may be set up by a logical channel modification only (section 2.1.1),

2. a new RAB may require an activation of logical and transport channels (section 2.1.2),

3. a new RAB includes logical, transport and physical channel activation (section 2.1.3).

2.1.1 Logical Channel Activation only

After getting the RAB Establishment Request primitive from the NAS including some QoS parameters the RNC-RRC determines the amount of resources which are required and can be assigned for this bearer. In this case the new RAB can be established in a way that the existing physical and transport channels are sufficient to provide the new RAB. The new logical channel is multiplexed into an existing DCH.

The RNC-RRC sends a RAB set up request message via the Signalling Link to the UE-RRC. This request contains physical, RLC and MAC control information. The UE-RRC acknowledges this request by a complete

message and configures its MAC and creates a new RLC instance.

The RNC-RRC receives the RAB set up complete message and configures its MAC and RLC.

Finally, a RAB Establishment Indication primitive is sent by the UE-RRC and a RAB Establishment Conformation primitive by the RNC-RRC.
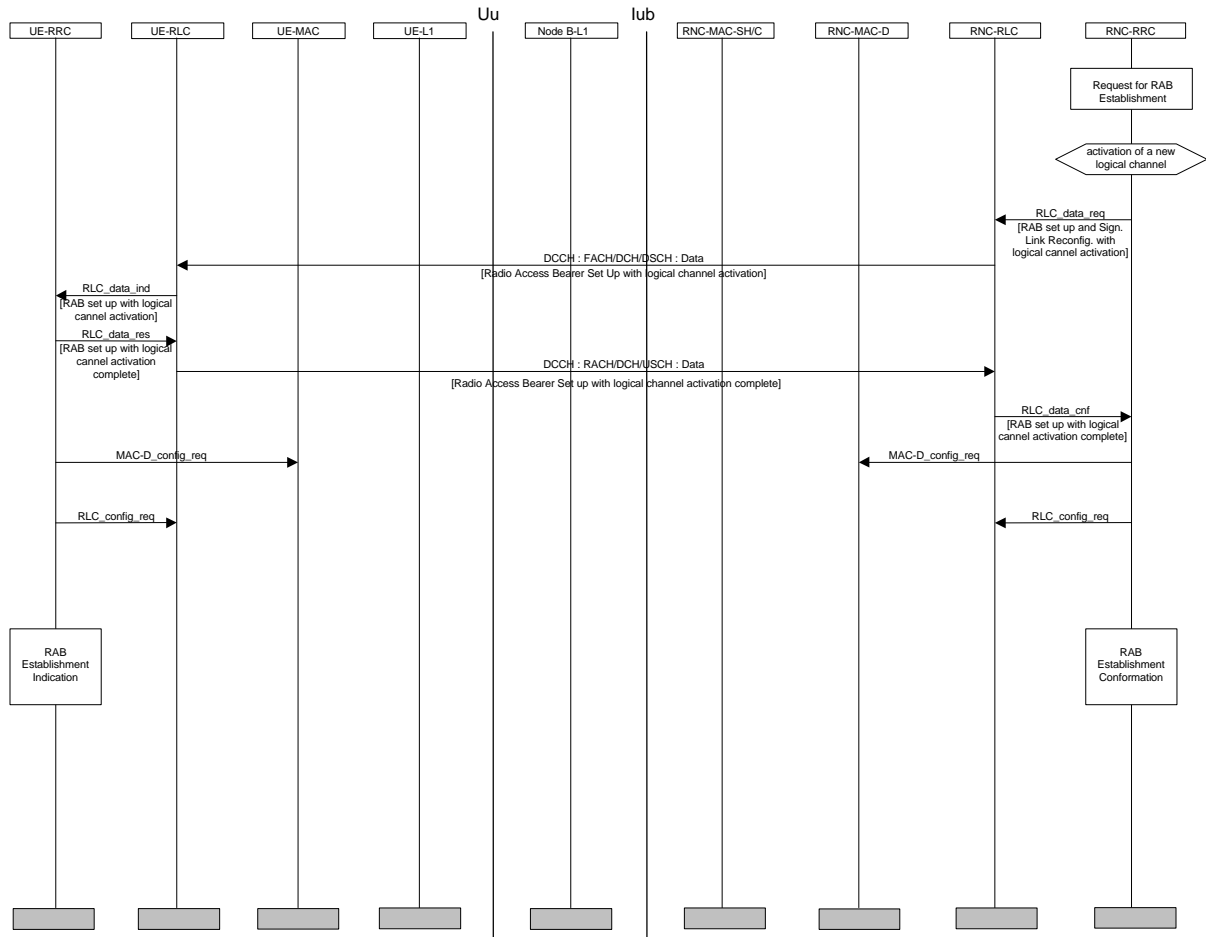

Figure 1: Radio Access Bearer Establishment with Logical Channel Activation only

2.1.2 With Transport Channel Activation

In this case the new RAB can be established in a way that the existing physical channels are sufficient to provide the new RAB. That means a new DCH is added keeping the number of physical resources for the mobile. Nevertheless the TFCS table has to be modified and the MAC and the physical layer have to be reconfigured accordingly.

Moreover, the RNC-RRC decides whether it is useful to perform a Signalling Link Reconfiguration or keep the existing Signalling Link. If it is useful the RNC-RRC sends the Signalling Link Reconfiguration parameters combined with the Radio Access Bearer set up message to the UE-RRC.
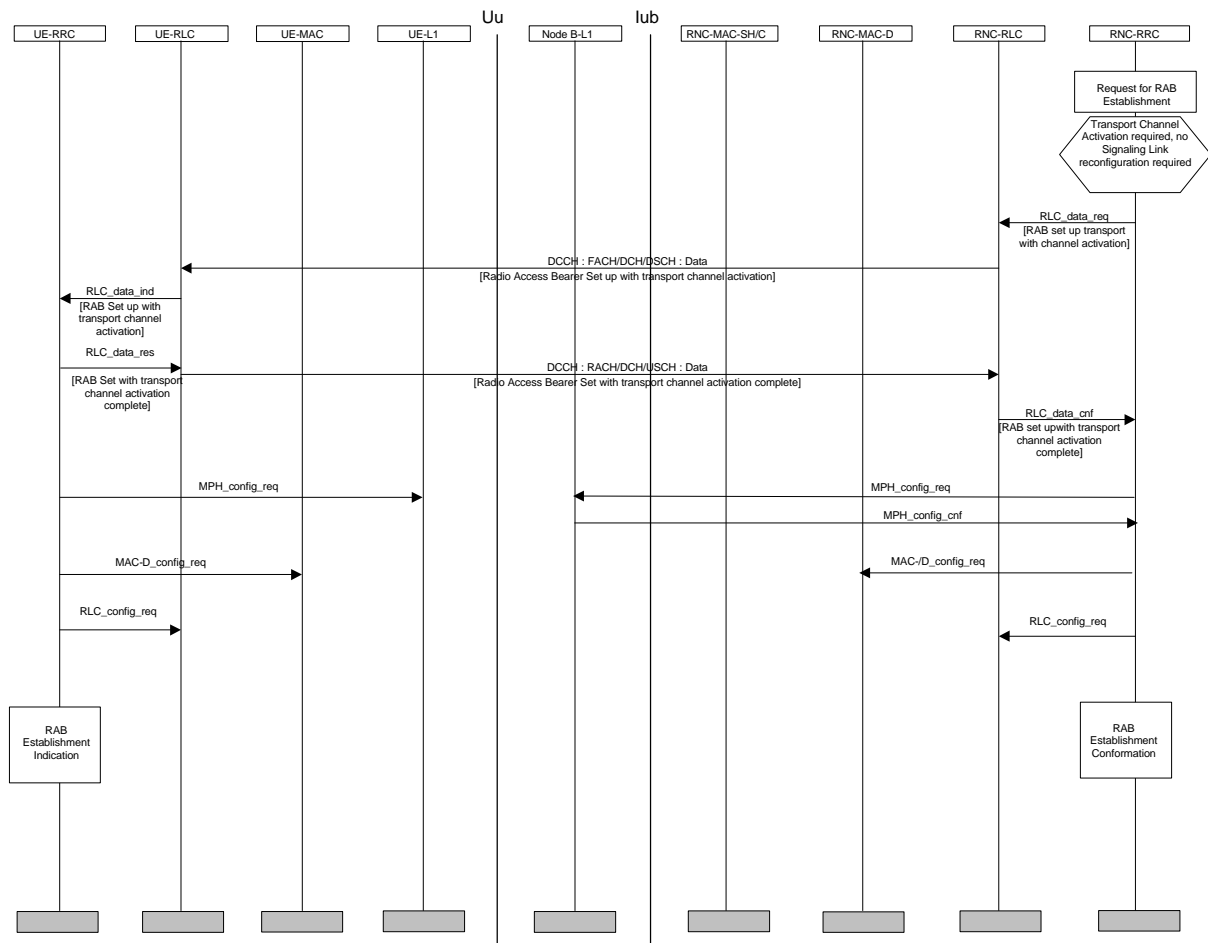
Figure 2: Radio Access Bearer Establishment with Transport Channel Activation

2.1.3 With Physical Channel Activation

The following flow shown the case when the new RAB requires also new physical layer resources, e.g. a new physical channel set up as a result of the RAB set up request. Moreover, the TFCS table has to be modified, the MAC reconfigured and new physical layer parameters has to be set.

Again, like in the previous section the RNC-RRC decides whether it is useful to perform a Signalling Link Reconfiguration or keep the existing Signalling Link. If it is useful to make a Signalling Link Reconfiguration the RNC-RRC sends the Signalling Link Reconfiguration parameters combined with the Radio Access Bearer set up message to the UE-RRC.
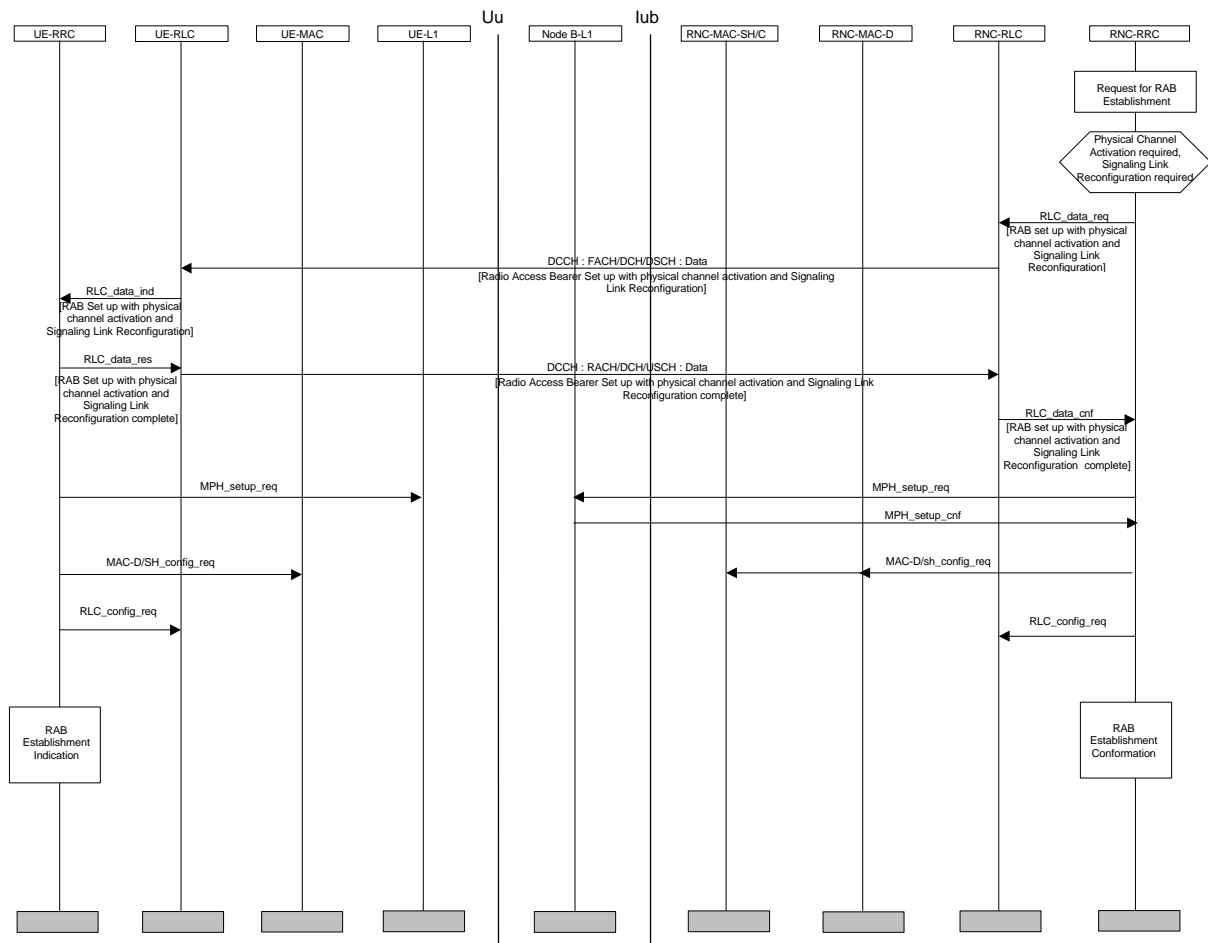
Figure 3: Radio Access Bearer Establishment with Physical Channel Activation

2.2 With Shared Channel Activation

In this section a new RAB is established by assigning USCH/DSCH resources instead of dedicated channel resources.

Shared channel resources are controlled by the MAC-sh to an individual mobile autonomously. However, the RNC-RRC has the control over the total amount of shared capacity within a cell and informs the MAC-sh about the amount and QoS (ffs) of these shared resources. The MAC-sh itself considers the shared channel capacity as a common pool of resources, which are assigned to the mobiles dynamically.

After getting the RAB Establishment Request primitive from the NAS including some QoS parameters the RNC-RRC checks whether the capacity of shared channel resources is sufficient to admit the new bearer.

When the existing shared capacity resources are not sufficient to provide the requested QoS, then the shared channel capacity needs modification like it is shown in the following figure.

After then the RNC-RRC sends a RAB set up request with shared channel activation message via the Signalling Link to the UE-RRC. This request contains physical, RLC and MAC control information. The UE-RRC acknowledges this request by a complete message and configures its MAC and creates a new RLC instance.

The RNC-RRC receives the RAB set up complete message and configures its MAC and RLC accordingly.

Finally, a RAB Establishment Indication primitive is sent by the UE-RRC and a RAB Establishment Conformation primitive by the RNC-RRC.
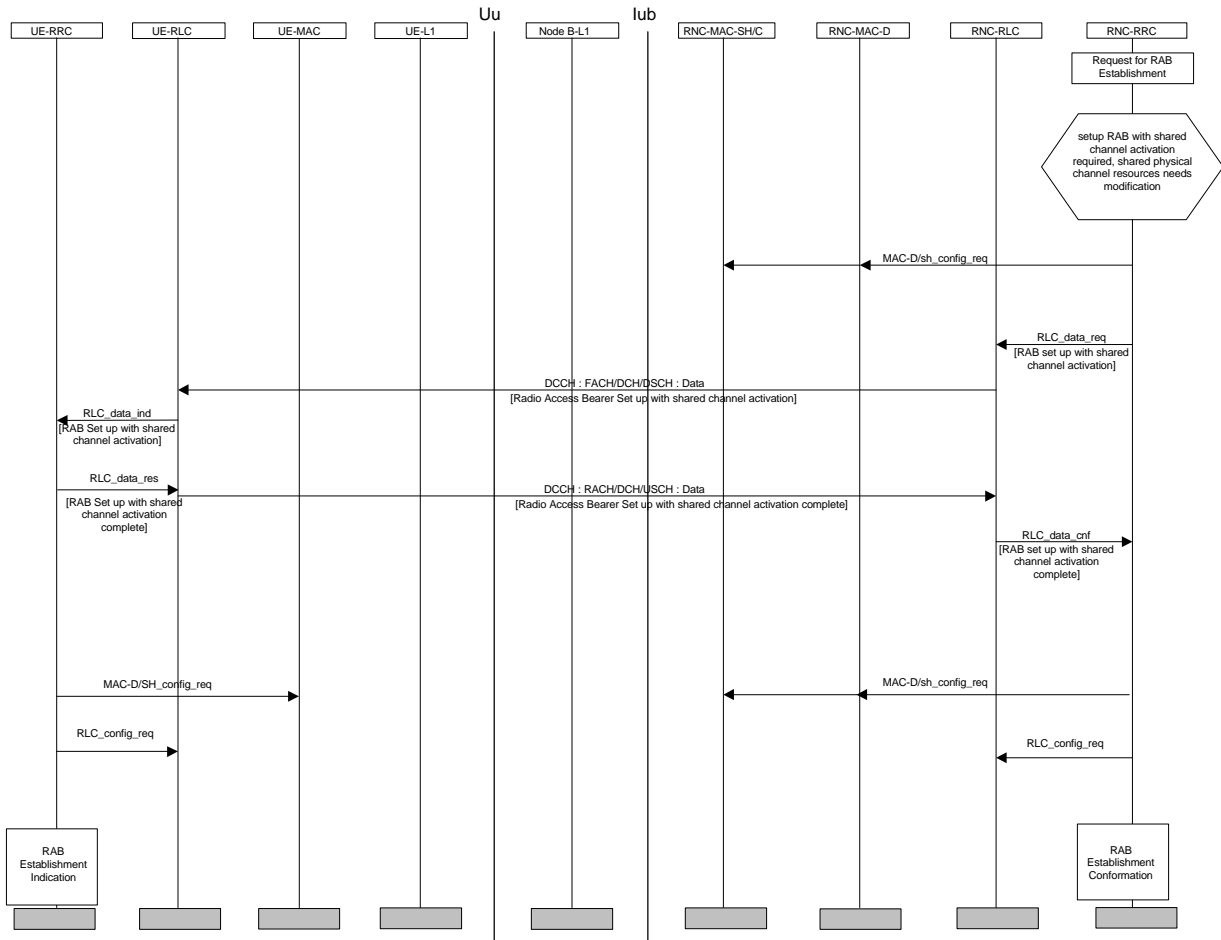
Figure 4: Radio Access Bearer Establishment with Shared Channel Capacity Modification and Activation

3 Radio Access Bearer Release

In the following sections the Radio Access Bearer Release when dedicated channel resources and shared channel resources are used is considered. As it is stated in the beginning of the RAB establishment sections the case when a RAB is associated with common channel capacity is not considered.

3.1 With Dedicated Channel Release

Depending on which Radio Access Bearer has to be released and which RAB shall be kept, we have to consider three different cases, whereas only case 3 is explicitly shown in this section:

1. the release of a RAB requires a logical channel release only,

2. the release of a RAB requires both logical and transport channel release,

3. the release of a RAB requires all logical, transport and physical channel release (see figure 5).

For simplification reasons case 3 is discussed in the following. After reception of a RAB Release Request the RNC-RRC determines whether a combined Signalling Link Reconfiguration is needed. If a Signalling Reconfiguration is required the RNC-RRC sends the Signalling Link Reconfiguration parameters combined with the Radio Access Bearer Release message to the UE-RRC.

The RNC-RRC sends a RAB release request message to the UE-RRC. The UE-RRC acknowledges the request by a complete message and configures its MAC, RLC and physical layer.

The RNC-RRC receives the RAB release complete message and configures its MAC, RLC and physical layer

accordingly.

Finally, a RAB Release Indication primitive is sent by the UE-RRC and a RAB Release Conformation primitive by the RNC-RRC.
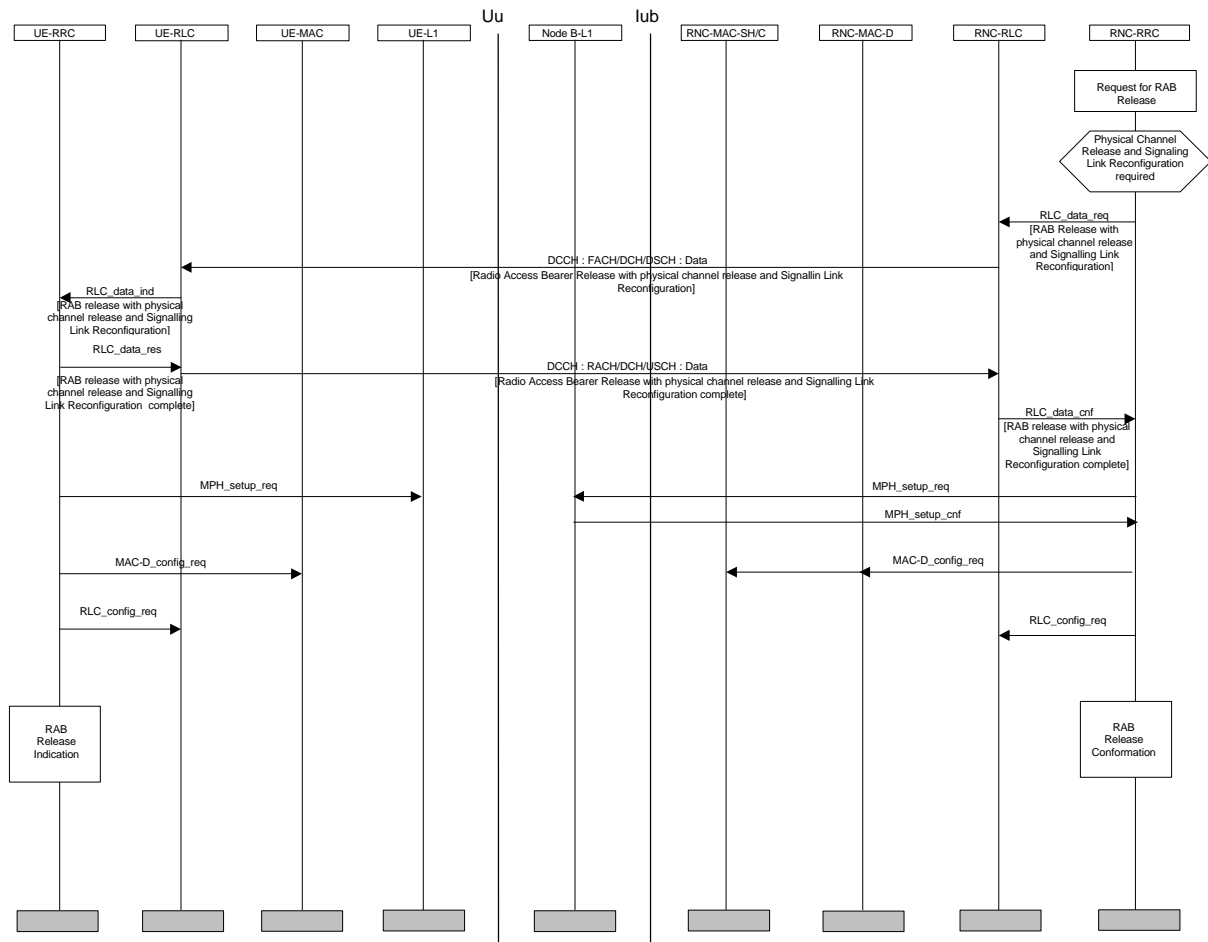

Figure 5: Radio Access Bearer Release with logical, transport and physical channel release

3.2 With Shared Channel Release

After getting the RAB Release primitive from the NAS the RNC-RRC sends a RAB release message to the UE-RRC.The UE-RRC acknowledges this message by a complete message and configures its MAC and RLC instance.

The RNC-RRC receives the RAB release complete message and configures its MAC and RLC accordingly.

Finally, a RAB Release Indication primitive is sent by the UE-RRC and a RAB Release Conformation primitive by the RNC-RRC.

After the RAB is released the RNC-RRC checks whether it is useful to reduce the total amount of allocated shared physical resources within the cell by help of a shared physical capacity modification procedure like it is shown in the following figure. In most cases it is useful to keep shared physical resources until this resources are requested for e.g. dedicated physical channels. The RNC-RRC informs the MAC-sh about a shared physical capacity reduction. The MAC-sh itself always considers the shared channel capacity as a common pool of resources, which are assigned to the mobiles dynamically.
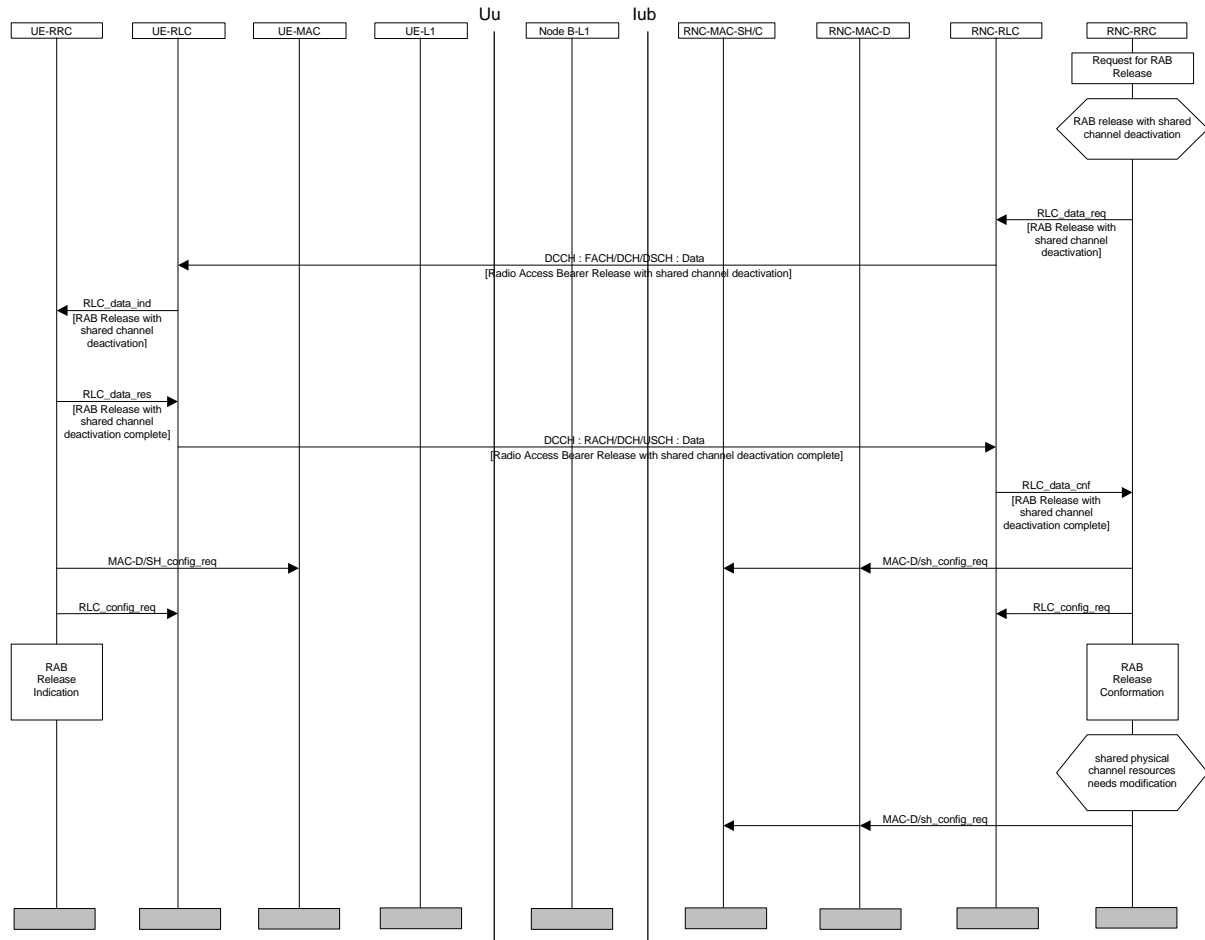
Figure 6: Radio Access Bearer Release with Shared Channel Capacity Modification

4 Conclusions

As shown in the figures above there are some significant differences to the FDD operation. Therefore, it is proposed to incorporate this material anyway into the relevant specifications.

5 References

[1]   3GPP S2.01 Radio Interface Protocol Architecture
[2]   3GPP S2.03 UE Functions and Interlayer Procedures in Connected Mode
[3]   3GPP S2.21 MAC Protocol Specification
[4]   3GPP RAN2 TDocs 31,32,33/99 Uplink Shared Channel (USCH), Motorola