TEXAS INSTRUMENTS

Low Level Design

ACI/CSD ENTITIES INTERFACE

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Notes:

1. Initial version

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[7010.801]   References and Vocabulary, Texas Instruments

[8448.201.01.012]   DTI Data Transmission Interface Library, Detailed Specification

1   Introduction

This document is a Low Level Design (LLD) Description of the modified ACI/CSD Entities Interface. Up to now the Rate Adaptation functional interface (RA) is controlled by ACI directly.

In order to separate the L1 functions and the ACI tasks it is proposed that RA shall be activated, deactivated, or modified by the adjacent higher layer entities FAD, RLP, and TRA(TCSD).

1.1   General Description

Figure 1. shows the different DTI connections of the various Circuit Switched Data services and the involved entities in detail without any underlaying activation mechanism.
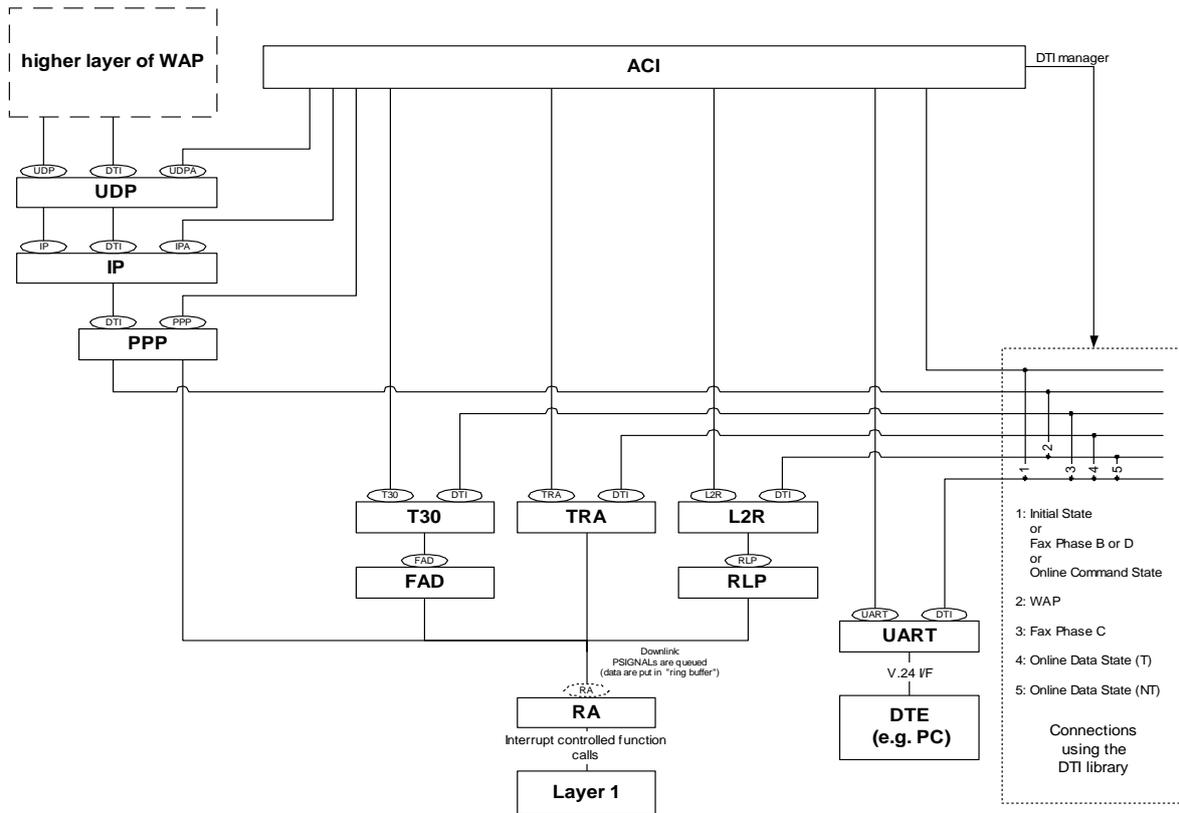
Figure 1: GSM entities of Circuit Switched Data transfer

2 Overview of the Activation/Deactivation Sequences (RAT-GSM)

In the following an overview of the different activation/deactivation sequences and the related call control primitives is given. For the sake of clarity for each different case the typical sequence of expected AT commands/responses is annotated.

2.1 Mobile originated calls (MOC)

2.1.1 Transparent data call (MOC_TD)
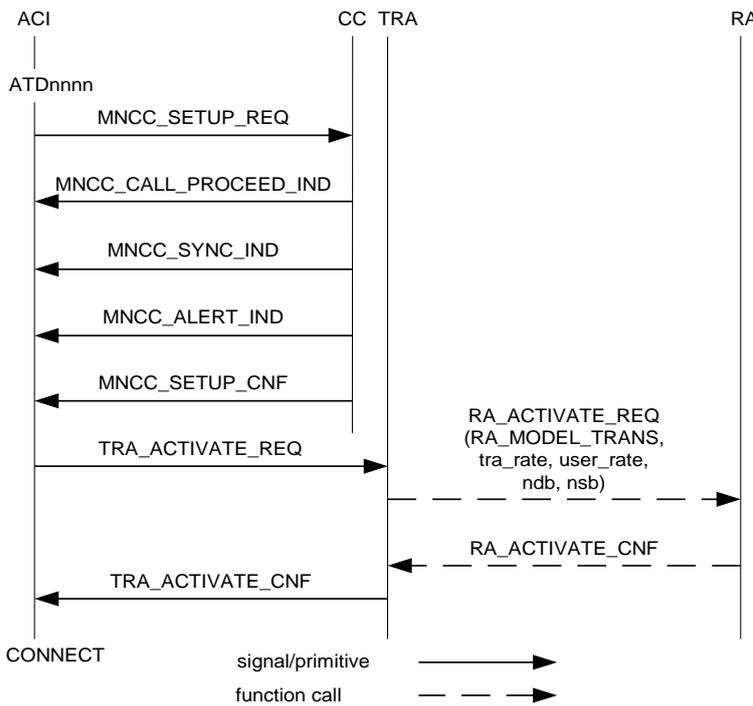
Figure 2: Activation of transparent CSD transfer

2.1.1.1 Calling party hangs up (MOC_TD_APH)

```
      ACI                      CC TRA                   RA
       |                         | |                    |
      +++
      OK    or DTR drop
      ATH
       |   TRA_DEACTIVATE_REQ    | |                    |
       |────────────────────────▶| |                    |
       |                         | |  RA_DEACTIVATE_REQ |
       |                         | |─ ─ ─ ─ ─ ─ ─ ─ ─ ─▶|
       |                         | |  RA_DEACTIVATE_CNF |
       |                         | |◀─ ─ ─ ─ ─ ─ ─ ─ ─ ─|
       |   TRA_DEACTIVATE_CNF    | |                    |
       |◀────────────────────────| |                    |
       |  MNCC_DISCONNECT_REQ    | |                    |
       |────────────────────────▶| |                    |
       |   MNCC_RELEASE_IND      | |                    |
       |◀────────────────────────| |                    |
       |                         | |                    |
      OK          signal/primitive  ───────────▶
                  function call     ─ ─ ─ ─ ─ ─▶
```
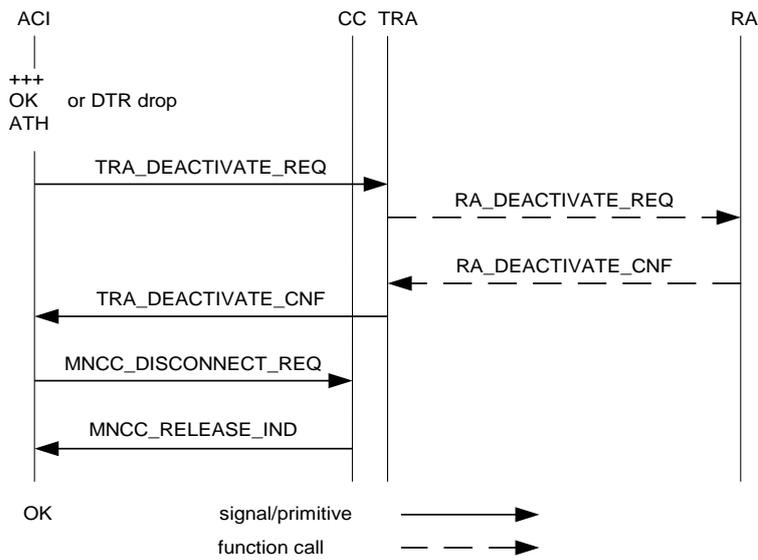
Figure 3: Dectivation of transparent CSD transfer (calling party hangs up)

2.1.1.2 Called party hangs up (MOC_TD_BPH)

```
      ACI                      CC TRA                   RA
       |                         | |                    |
       |    MNCC_RELEASE_IND     | |                    |
       |◀────────────────────────| |                    |
       |   TRA_DEACTIVATE_REQ    | |                    |
       |────────────────────────▶| |                    |
       |                         | |  RA_DEACTIVATE_REQ |
       |                         | |─ ─ ─ ─ ─ ─ ─ ─ ─ ─▶|
       |                         | |  RA_DEACTIVATE_CNF |
       |                         | |◀─ ─ ─ ─ ─ ─ ─ ─ ─ ─|
       |   TRA_DEACTIVATE_CNF    | |                    |
       |◀────────────────────────| |                    |
       |                         | |                    |
   NO CARRIER       signal/primitive  ───────────▶
                    function call     ─ ─ ─ ─ ─ ─▶
```
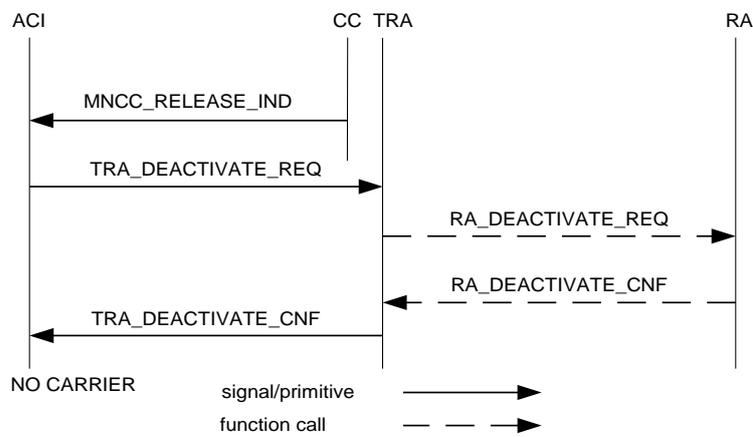
Figure 4: Dectivation of transparent CSD transfer (called party hangs up)

2.1.2 Non-transparent data call (MOC_NT)
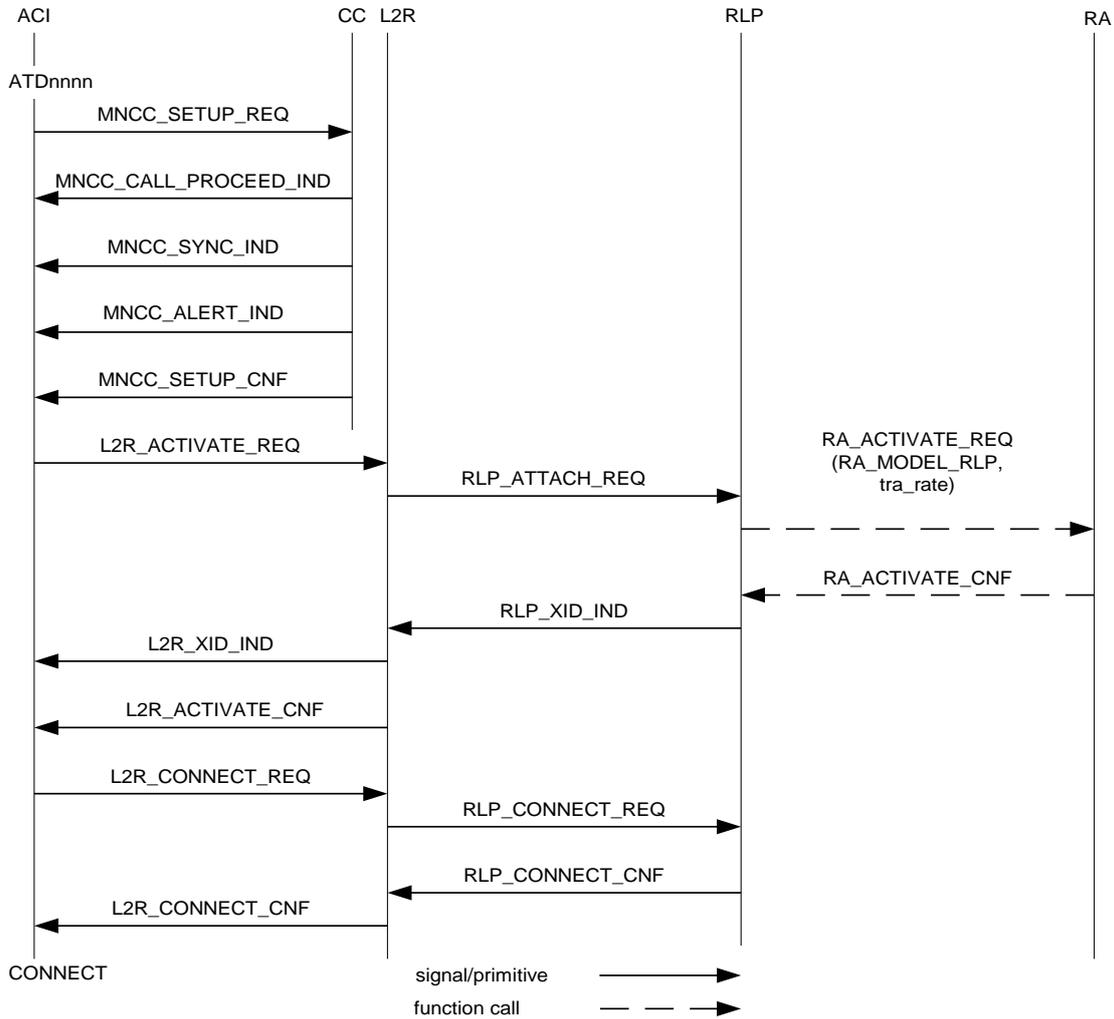
Figure 5: Activation of non-transparent CSD transfer

2.1.2.1   Calling party hangs up (MOC_NT_APH)
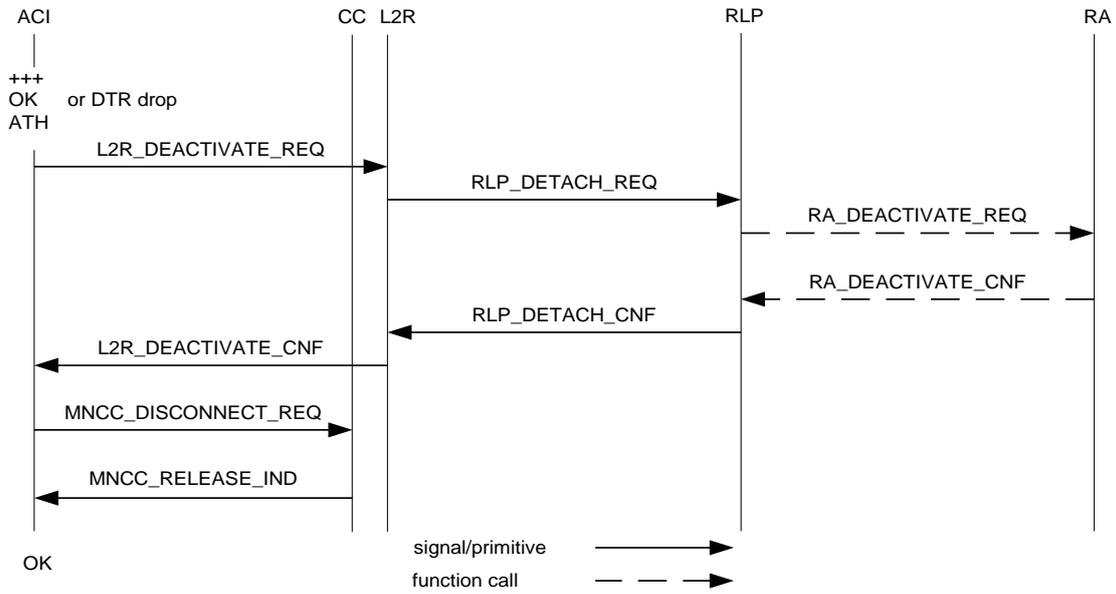
Figure 6: Dectivation of non-transparent CSD transfer (calling party hangs up)

2.1.2.2   Called party hangs up (MOC_NT_BPH)
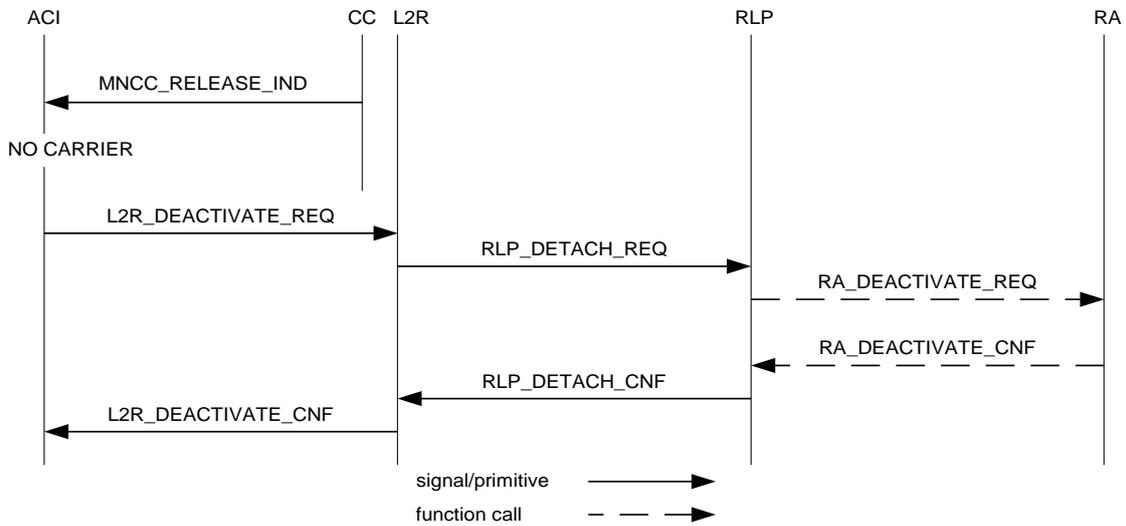
Figure 7: Dectivation of non-transparent CSD transfer (called party hangs up)

2.1.3 Fax call (MOC_FX)
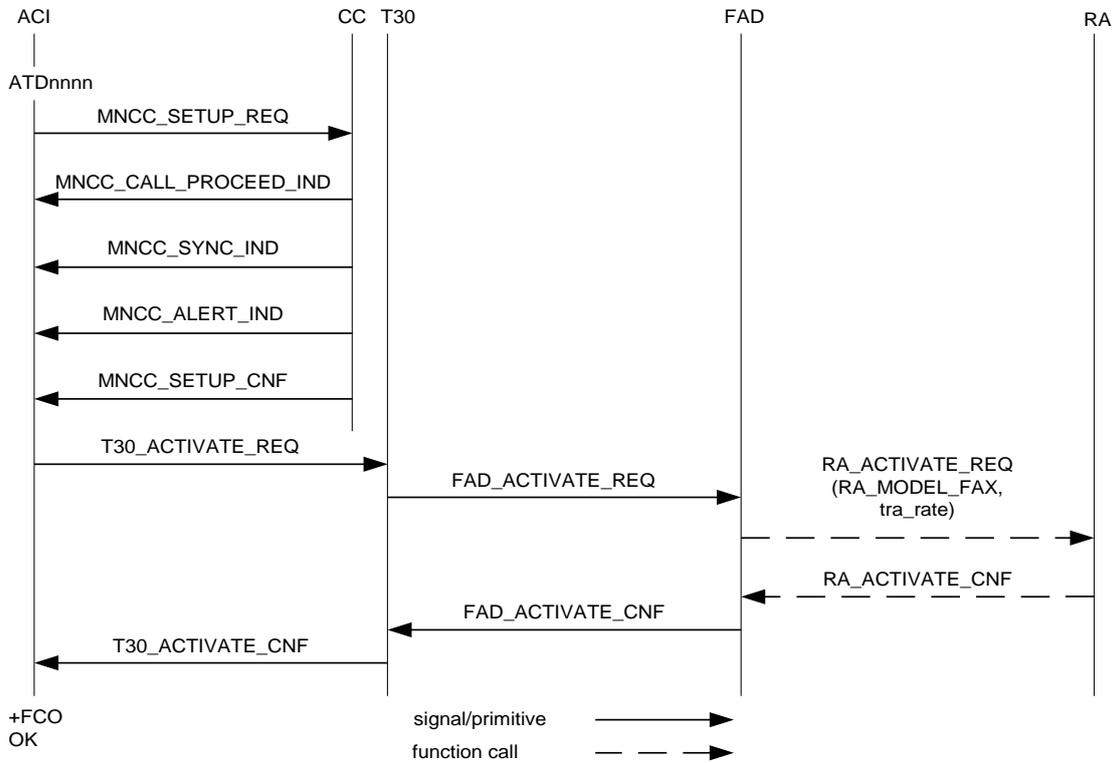
Figure 8: Activation of Fax call

2.1.3.1 Calling party hangs up (MOC_FX_APH)
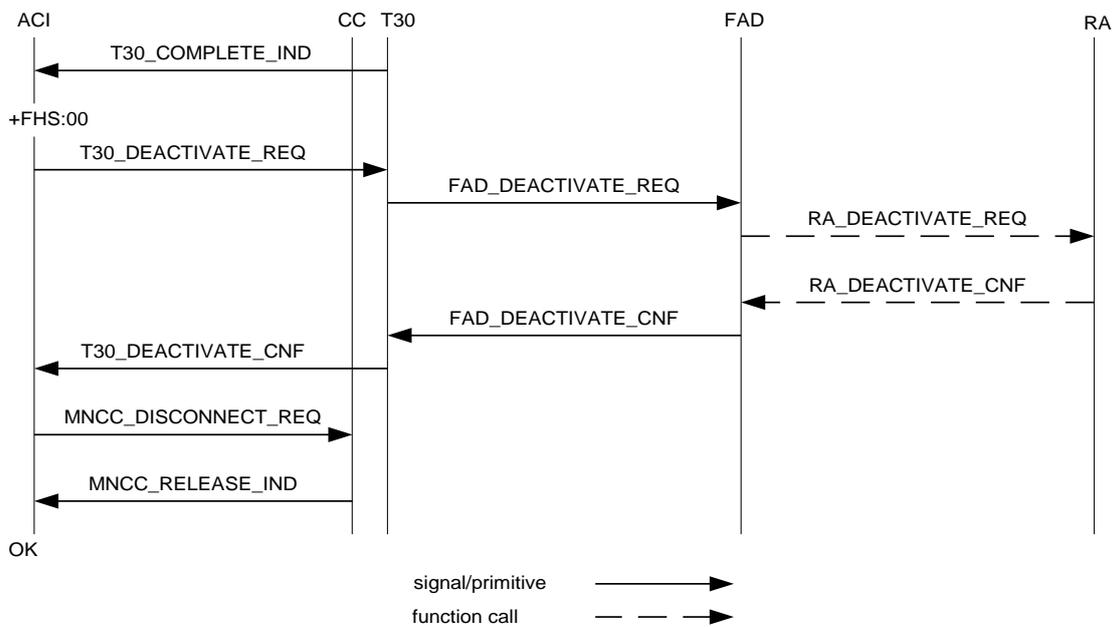
Figure 9: Calling party hangs up (normal end)

2.1.3.2 Called party hangs up (MOC_FX_BPH) - error
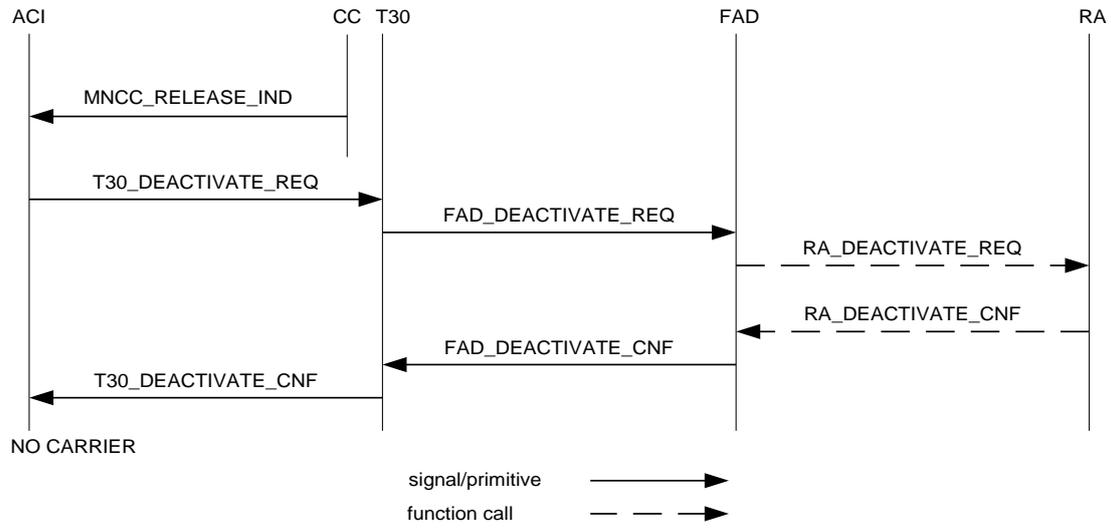
Figure 10: Called party hangs up (error)

2.2 Mobile terminated calls (MTC)

2.2.1 Non-transparent data call (MTC_NT)
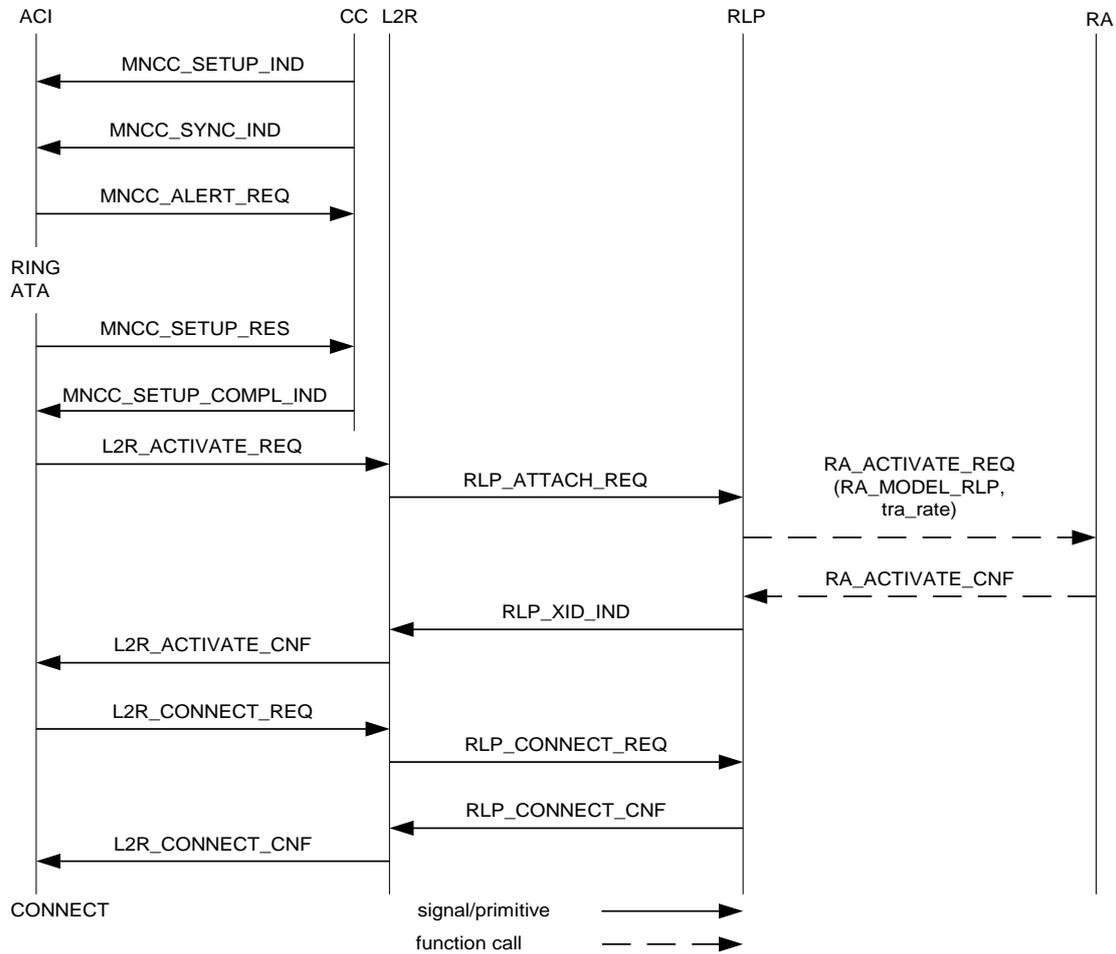
Figure 11: Activation of non-transparent CSD transfer

2.2.1.1   Calling party hangs up (MTC_NT_APH)

```
   ACI              CC  L2R              RLP              RA
    |               |    |                |               |
    |  MNCC_RELEASE_IND  |                |               |
    |<───────────────|   |                |               |
    |                |   |                |               |
 NO CARRIER          |   |                |               |
    |                |   |                |               |
    |  L2R_DEACTIVATE_REQ |                |               |
    |────────────────>|  |                |               |
    |                |   |  RLP_DETACH_REQ |               |
    |                |   |───────────────>|               |
    |                |   |                |  RA_DEACTIVATE_REQ |
    |                |   |                |─ ─ ─ ─ ─ ─ ─ ─>|
    |                |   |                |  RA_DEACTIVATE_CNF |
    |                |   |                |<─ ─ ─ ─ ─ ─ ─ ─|
    |                |   |  RLP_DETACH_CNF |               |
    |                |   |<───────────────|               |
    |  L2R_DEACTIVATE_CNF |                |               |
    |<───────────────|   |                |               |
    |                |   |                |               |
```

signal/primitive ────────>
function call   ─ ─ ─ ─ >
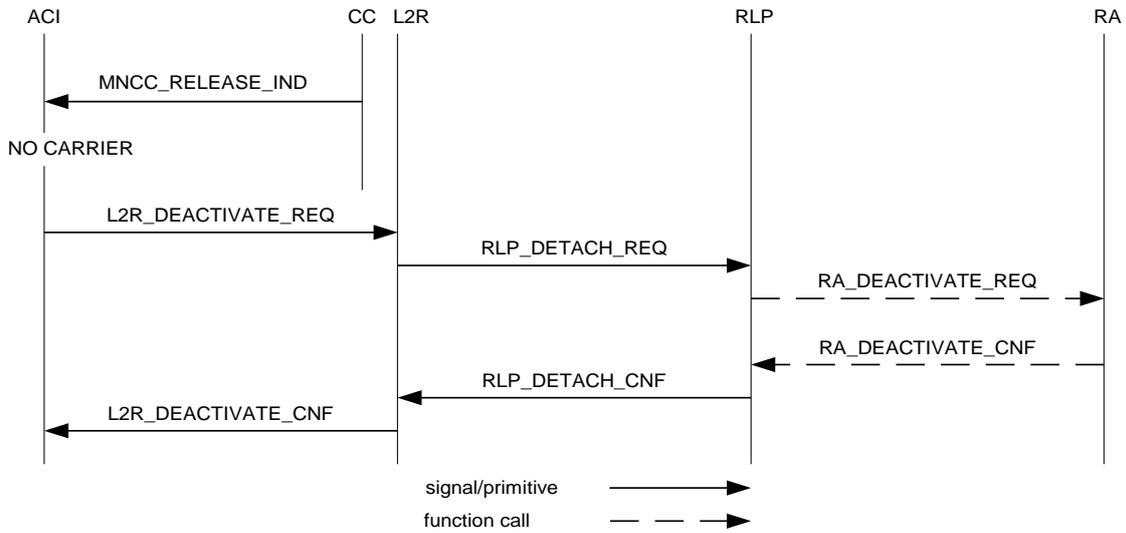
Figure 12: Dectivation of non-transparent CSD transfer (calling party hangs up)

2.2.1.2   Called party hangs up (MTC_NT_BPH)

```
   ACI              CC  L2R              RLP              RA
    |               |    |                |               |
   +++              |    |                |               |
   OK     or DTR drop    |                |               |
   ATH             |    |                |               |
    |  L2R_DEACTIVATE_REQ |                |               |
    |────────────────>|  |                |               |
    |                |   |  RLP_DETACH_REQ |               |
    |                |   |───────────────>|               |
    |                |   |                |  RA_DEACTIVATE_REQ |
    |                |   |                |─ ─ ─ ─ ─ ─ ─ ─>|
    |                |   |                |  RA_DEACTIVATE_CNF |
    |                |   |                |<─ ─ ─ ─ ─ ─ ─ ─|
    |                |   |  RLP_DETACH_CNF |               |
    |                |   |<───────────────|               |
    |  L2R_DEACTIVATE_CNF |                |               |
    |<───────────────|   |                |               |
    |  MNCC_DISCONNECT_REQ|                |               |
    |────────────────>|  |                |               |
    |  MNCC_RELEASE_IND  |                |               |
    |<───────────────|   |                |               |
   OK               |    |                |               |
```

signal/primitive ────────>
function call   ─ ─ ─ ─ >
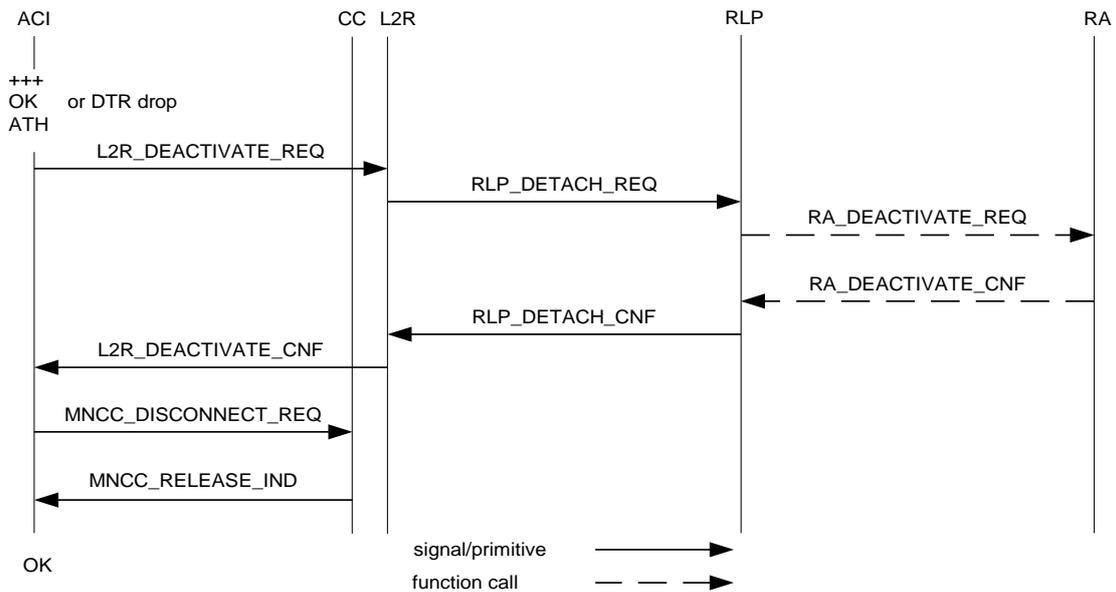
Figure 13: Dectivation of non-transparent CSD transfer (called party hangs up)

2.2.2 Fax call (MTC_FX)
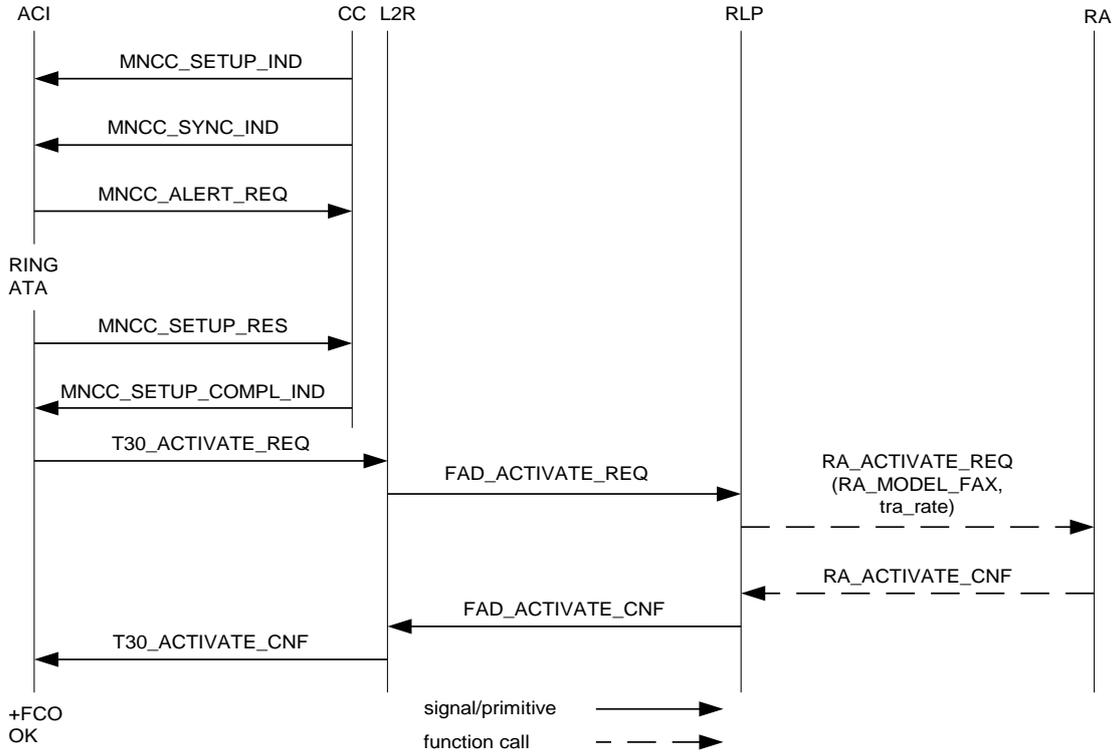
Figure 14: Activation of Fax call

2.2.2.1   Calling party hangs up (MTC_FX_APH)
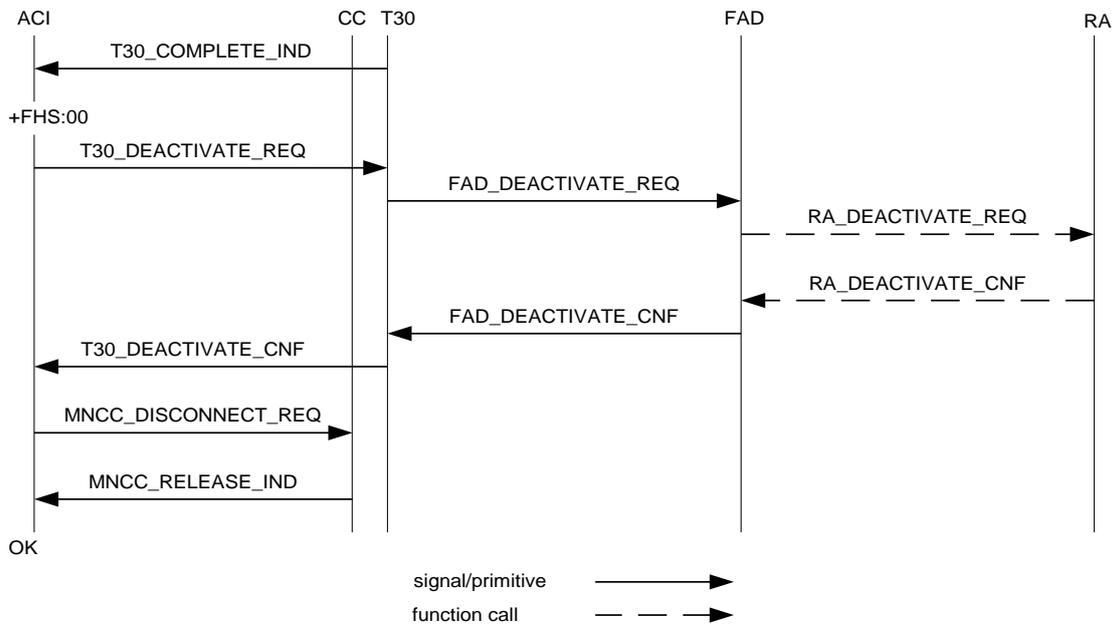
Figure 15: Calling party hangs up (normal end)

2.2.2.2 Called party hangs up (MTC_FX_BPH) - error
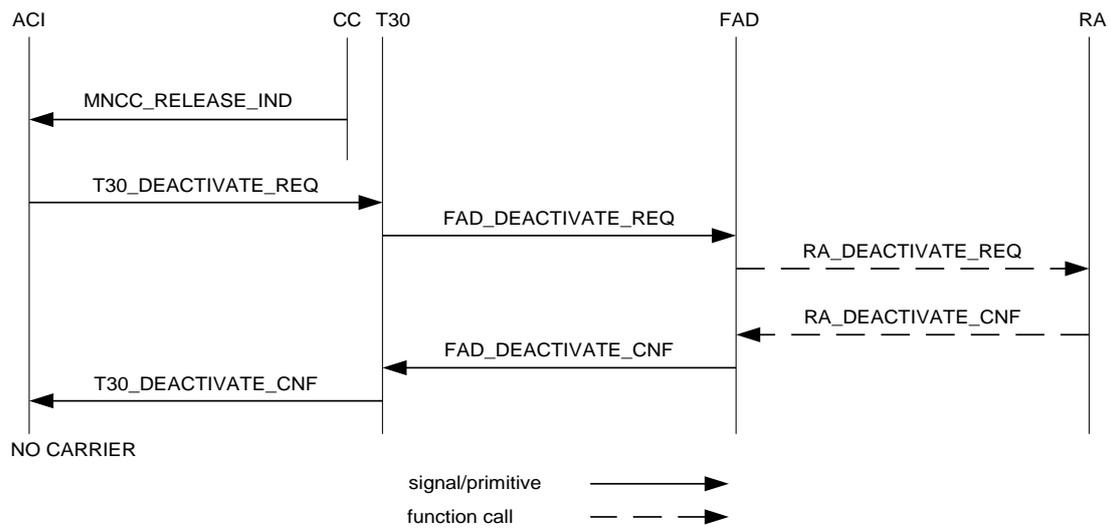
Figure 16: Called party hangs up (error)

2.3 In-Call Modification

2.3.1 AT+CMOD=1 (Repeat Indicator = RI_CIRCULAR)

f.f.s

2.3.2 AT+CMOD=2 (Repeat Indicator = RI_CIRCULAR)

#### 2.3.2.1 ICM local initiated

2.3.2.1.1 Transition voice/data
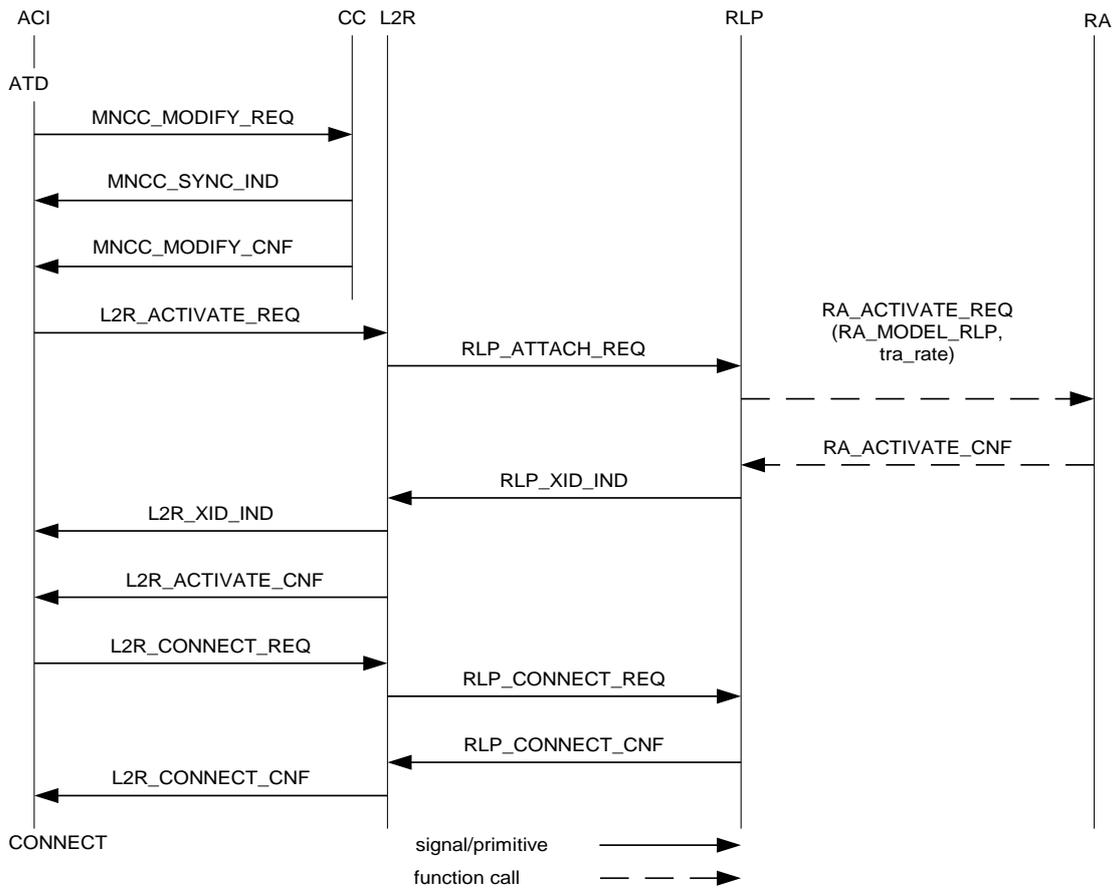
Figure 17: ICM local initiated (voice/data)

2.3.2.1.2 Transition data/voice

f.f.s

2.3.2.2 ICM remote initiated

f.f.s

2.3.3 AT+CMOD=3 (Repeat Indicator = RI_SEQUENTIAL)

f.f.s

2.4 Channel Mode Modification during Fax call

```
 ACI              CC  T30              FAD                  RA
  |<---------------|   |                |                    |
  |  MNCC_SYNC_IND |   |                |                    |
  |                    |                |                    |
  |  T30_MODIFY_REQ    |                |                    |
  |------------------->|                |                    |
  |                    | FAD_MODIFY_REQ |                    |
  |                    |--------------->|   RA_MODIFY_REQ    |
  |                    |                |   (tra_rate)       |
  |                    |                |- - - - - - - - - ->|
  |                    |                |                    |
  |                    |                |   RA_MODIFY_CNF    |
  |                    |                |<- - - - - - - - - -|
  |                    | FAD_MODIFY_CNF |                    |
  |                    |<---------------|                    |
  |  T30_MODIFY_CNF    |                |                    |
  |<-------------------|                |                    |
```

signal/primitive   ———————►

function call   — — — ►
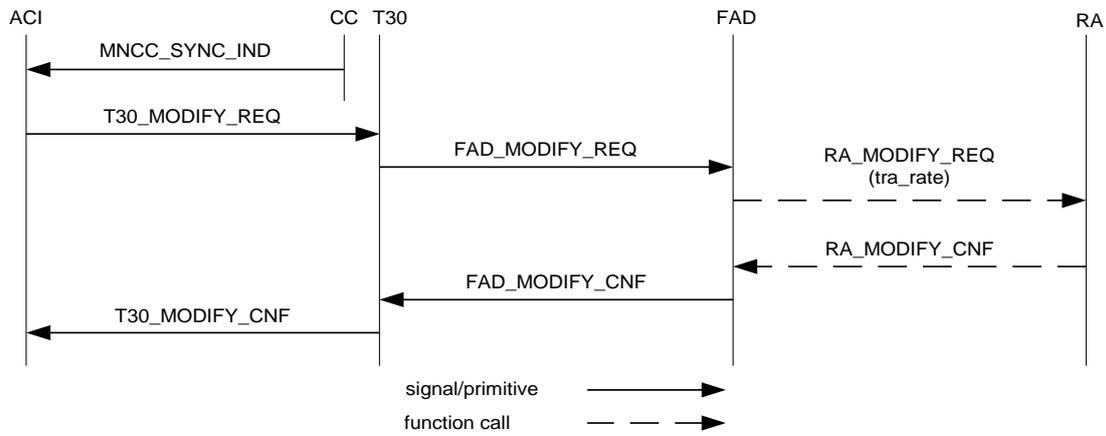
Figure 18: Channel Mode Modification during Fax call

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2.5 Rate Adaptation activation/modification parameters

All required Rate Adaptation activation/modification parameters have to be provided by ACI via the intermediate layers down to the RA module.

2.5.1 Transparent data call activation

The RA initialization requires:

```
conf_b_itc := V_ITC_DATA

conf_b_ce := V_CE_TRANSP

conf_b_ct := {V_CT_FR, V_CT_HR}

conf_b_ur := {V_UR_300, V_UR_1200, V_UR_2400, V_UR_4800,
              V_UR_9600, V_UR_14400}

conf_b_ndb := {V_NDMSK_B_7_DBITS, V_NDMSK_B_8_DBITS}

conf_b_nsb := {V_NSB_ONE_STOP, V_NSB_TWO_STOP}
```

I.e., the primitive TRA_ACTIVATE_REQ must contain the parameters:

```
tra_rate := {TRA_HALFRATE_2400, TRA_FULLRATE_2400, TRA_HALFRATE_4800,
             TRA_FULLRATE_4800, TRA_FULLRATE_9600, TRA_FULLRATE_14400}

user_rate := {URA_300, URA_1200, URA_2400, URA_4800, URA_9600, URA_14400}

ndb := {7, 8}

nsb := {1, 2}
```

2.5.2 Non-transparent data call activation

The RA initialization requires:

```
conf_b_itc := V_ITC_DATA

conf_b_ce := V_CE_NON_TRANSP

conf_b_ct := {V_CT_FR, V_CT_HR}

conf_b_ur := {V_UR_4800, V_UR_9600, V_UR_14400}
```

I.e., the primitives L2R_ACTIVATE_REQ and RLP_ATTACH_REQ must contain the parameter:

```
tra_rate := {TRA_HALFRATE_4800, TRA_FULLRATE_4800,
             TRA_FULLRATE_9600, TRA_FULLRATE_14400}
```

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2.5.3 Fax call activation

The RA initialization requires:

```
conf_b_itc := V_ITC_FAX

conf_b_ce := V_CE_TRANSP

conf_b_ct := {V_CT_FR, V_CT_HR}

conf_b_ur := {V_UR_2400, V_UR_4800, V_UR_9600, V_UR_14400}
```

I.e., the primitives T30_ACTIVATE_REQ and FAD_ ACTIVATE_REQ must contain the parameter:

```
tra_rate := {TRA_HALFRATE_2400, TRA_FULLRATE_2400, TRA_HALFRATE_4800,
             TRA_FULLRATE_4800, TRA_FULLRATE_9600, TRA_FULLRATE_14400}
```

2.5.4 Fax call modification

The RA re-initialization requires:

```
conf_b_itc := V_ITC_FAX

conf_b_ce  := V_CE_TRANSP

conf_b_ct  := {V_CT_FR, V_CT_HR}

conf_b_ur  := {V_UR_2400, V_UR_4800, V_UR_9600, V_UR_14400}
```

I.e., the primitives T30_MODIFY_REQ and FAD_MODIFY_REQ must contain the parameter:

```
tra_rate := {TRA_HALFRATE_2400, TRA_FULLRATE_2400, TRA_HALFRATE_4800,
             TRA_FULLRATE_4800, TRA_FULLRATE_9600, TRA_FULLRATE_14400}
```

Appendices

A. Acronyms

ACI	Application Control Interface
DTI	Data Transmission Interface
FAD	Fax Adaptation Entity
L2R	Layer 2 Relay Entity
RA	Rate Adaptation Function Module (is simulated as entity only)
RAT	Radio Access Technology
RLP	Radio Link Protocol Entity
T30	ITU-T.30 Fax Protocol Entity

B. Glossary

Entity	Program which executes the functions of a layer.
Message	A message is a data unit, which is transferred between the entities of the same layer (peer-to-peer) of the mobile and infrastructure side. Message is used as a synonym to protocol data unit (PDU). A message may contain several information elements.
Primitive	A primitive is a data unit, which is transferred between layers on one component (mobile station or infrastructure). The primitive has an operation code, which identifies the primitive and its parameters.
Service Access Point	A Service Access Point is a data interface between two layers on one component (mobile station or infrastructure).
Device	A data sink or source out of GSM/GPRS protocol stack

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