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This attached document is an updated specification on facsimile group 3 non-transparent (TS 23.146). The version 1.1.0 is the attached version 1.0.0 with acceptance of the proposed changes.

# 3G TS 23.146 V1.0.0 (1999-12)

*Technical Specification*

**3rd Generation Partnership Project;**
**Technical Specification Group Core Network;**
**Technical realization of facsimile group 3 non-transparent**
**(3G TS 23.146 version 1.0.0)**

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# Contents

# Foreword

This Technical Specification has been produced by the 3GPP.

This specification defines the technical realization of facsimile group 3 using non-transparent network support within the 3GPP system.

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of this TS, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 Indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the specification;

# 1 Scope

The present document deals with the procedures allowing the technical realization of the real time end-to-end facsimile group 3 service within the UMTSPLMN using non-transparent network support according to the definition of the Teleservices 61 and 62 specified in 02.03. Within this document particular attention is given to Teleservice "Alternate speech/facsimile group 3" (Teleservice 61). However, the definitions apply also to Teleservice "Automatic facsimile group 3" (Teleservice 62) with the exception of all actions concerned with the speech phase. Consequently, in the following descriptions the term "Teleservice" denotes both Teleservice 61 and Teleservice 62 as appropriate.

NOTE: Some facilities associated with alternate speech/ facsimile group 3 may not be available with version 1 of MAP. In particular, the in-call modification procedure following an inter MSC handover is not supported by this version. This imposes the limitation that for all calls it will not be possible to change between speech and facsimile following an inter MSC handover.

# 2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.


[1] GSM 01.04: "Digital cellular telecommunications system (Phase 2+); Abbreviations and acronyms".

[2] GSM 02.03: "Digital cellular telecommunications system (Phase 2+); Teleservices supported by a GSM Public Land Mobile Network (PLMN)".

[3] GSM 03.10: "Digital cellular telecommunications system (Phase 2+); GSM Public Land Mobile Network (PLMN) connection types".

[4] GSM 04.02: "Digital cellular telecommunications system (Phase 2+); GSM Public Land Mobile Network (PLMN) access reference configuration".

[5] 3G TS 24.008: " Mobile radio interface layer 3 specification".

[6] GSM 04.21: "Digital cellular telecommunications system (Phase 2+); Rate adaption on the Mobile Station - Base Station System (MS - BSS) interface".

[7] 3G TS 27.001: " General on Terminal Adaptation Functions (TAF) for Mobile Stations (MS)".

[8] 3G TS 27.002: " Terminal Adaptation Functions (TAF) for services using asynchronous bearer capabilities".

[9] 3G TS 29.007: "3GPP; TSG CN; General requirements on interworking between the Public Land Mobile Network (PLMN) and the Integrated Services Digital Network (ISDN) or Public Switched Telephone Network (PSTN)".

[10] ITU-T Recommendation F.160: "General operational provisions for the international public facsimile services".

[11] ITU-T Recommendation T.4: "Standardization of group 3 facsimile apparatus for document transmission".

[12] ITU-T Recommendation T.30: "Procedures for document facsimile transmission in the general switched telephone network".

[13] ITU-T Recommendation V.21: "300 bits per second duplex modem standardized for use in the general switched telephone network".

[14] ITU-T Recommendation V.24: "List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit-terminating equipment (DCE)".

[16] ITU-T Recommendation V.27 ter: "4 800/2 400 bits per second modem standardized for use in the general switched telephone network".

[17] ITU-T Recommendation V.29: "9 600 bits per second modem standardized for use on point-to-point 4-wire leased telephone-type circuits".

[18] ITU-T Recommendation V.17: "A 2-wire modem for facsimile applications with rates up to 14400 bit/s".

[19] ITU-T Recommendation X.300: "General principles and arrangements for interworking between public data networks, and between public data networks and other networks".

[20] ITU-T Recommendation T.38: "Procedures for real-time Group 3 facsimile communication over IP networks".

[21] ITU-T Recommendation X.691: "Information technology – ASN.1 encoding rules – Specification of Packed Encoding Rules (PER)".

[22] IETF RFC 1662: "PPP in HDLC-like Framing"

[23] IETF RFC 1661: "The Point-to-Point Protocol (PPP)"

[24] IETF RFC 1570: "PPP LCP Extensions"

[25] IETF RFC 1332: "The PPP Internet Protocol Control Protocol (IPCP)"

[26] IETF RFC 791: "Internet Protocol".

[27] IETF RFC 768: "User Datagram Protocol".

## 2.1 Abbreviations

In addition to those below abbreviations used in the present document are listed in GSM 01.04.

| | |
|---|---|
| BCS | Binary coded signalling |
| CCT | Circuit(s) |
| I/F | Interface |
| RA1,RA1',RA2 | Rate adaptation functions |

| | |
|---|---|
| SREJ | Selective reject |
| TAF | TAF usually shows a function of the UE side, but when IWF has the function that is equal to the UE side TAF, TAF is used to express the function of the IWF in this specification. |
| T-FAX | Transmission side facsimile |
| T-TAF | Transmission side terminal adaptation function |
| R-FAX | Reception side facsimile |
| R-TAF | Reception side terminal adaptation function |
| T-adaptor | Transmission side facsimile adaptor that does not have TAF capability. |
| R-adaptor | Reception side facsimile adaptor that does not have TAF capability. |
| MMI | Man-Machine Interface |
| IE | Information element |
| E-T.38 | A FAX protocol that T.38 is enhanced. This is defined newly in this specification. |

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The abbreviations for the facsimile specific protocol elements and signals are listed in appendix I.

# 3 Service definition

The fixed network facsimile group 3 service, as basically defined in ITU-T Recommendation F.160, is an international telematic service for document transmission between two facsimile group 3 terminals.

The service specifications are comprised of two parts:

- the control procedures described in ITU-T Recommendation T.30 and
- the document transmission coding described in ITU-T Recommendation T.4.

The UMTS facsimile group 3 Teleservice is intended to allow connections between facsimile group 3 terminals using:

- a UMTS PLMN as stand-alone facility for mobile-to-mobile communication;
- a UMTS PLMN to have access to fixed networks PSTN and/or ISDN for mobile to/from fixed network communication.

For this Teleservice, the coding of the facsimile document is as per ITU-T Recommendation T.4 and the protocol as per ITU-T Recommendation T.30 both modified within the PLMN as detailed in this specification.

The interworking between different networks is based on ITU-T Recommendation X.300.

The particular features of this Teleservice are:

- it uses point-to-point communication;
- the information transfer mode is circuit, duplex, asynchronous;
- the information transfer capability is alternate speech/ facsimile group 3 or facsimile group 3 only;
- both mobile originated and mobile terminated calls are supported;
- different end-to-end message speeds as per ITU-T Recommendation T.30 may be used within the same connection to match the appropriate quality requirements;
- use of the standard asynchronous terminal adaptation function for non-transparent network support (as per 3G TS 27.002) within the UE is envisaged.

# 4 Network architecture

The network architecture applicable to this Teleservice is shown in figure 1/23.146 below.

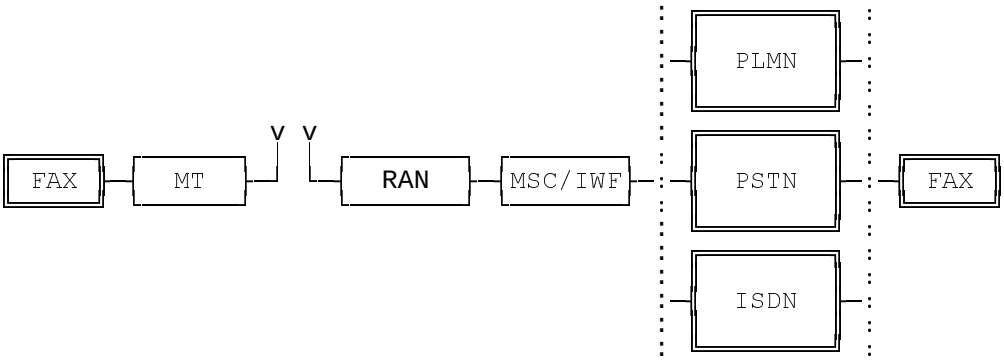


**Figure 1/23.146: Network architecture**

It shows the case of mobile to fixed network interworking. For mobile-to-mobile calls, there would effectively be a loop back within the PLMN using two IWFs.

# 5 Reference configuration at the mobile station

The mobile station reference configurations described in this clause are defined as per GSM 04.02.

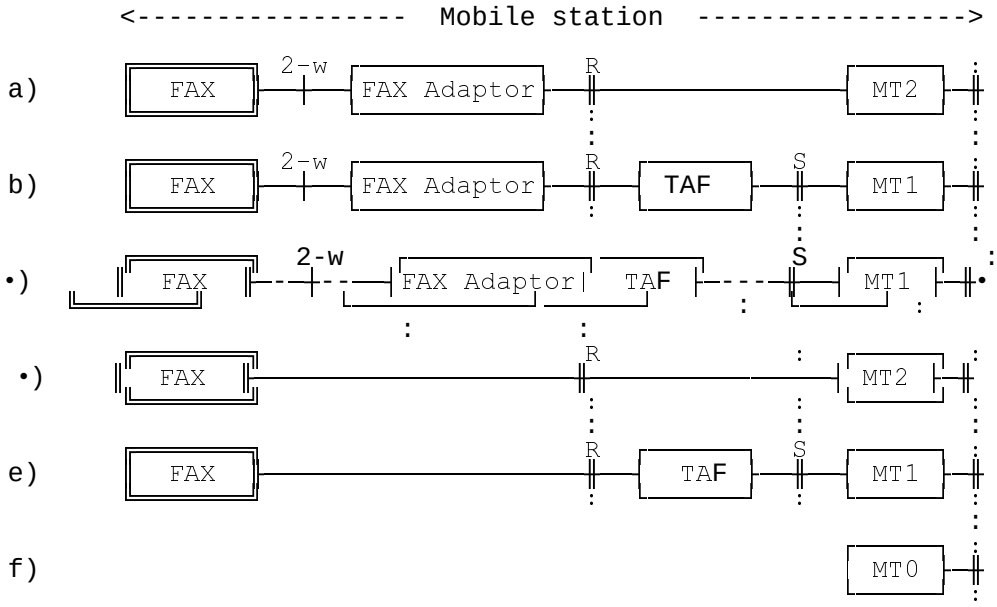


**Figure 2/23.146: Reference configurations**

The teleservice definitions in GSM 02.03 regard the facsimile group 3 terminal as a 2-wire analogue terminated equipment. In order to connect this to the MT2 a separate "fax adaptor" device is necessary. This configuration, shown in figure 2a/23.146, shall be considered as the standard configuration, so that all the existing facsimile group 3 terminals may be connected to the PLMN.

An alternative realization would be to combine a facsimile group 3 terminal and the fax adaptor into a special "UMTS facsimile machine", directly providing a digital output. Although such a terminal shall appear to the MT2 as identical as the fax adaptor (i.e. with an identical interface and protocol), it would allow for a significantly smaller and simpler facsimile machine. This configuration is shown in figure 2d/23.146.

In addition of course, it is always possible to realize an MT0, as per figure 2f/23.146 , where both the facsimile and mobile termination functions are considered to be part of one integrated unit.

The remaining configurations concern the use of an S interface and are considered as optional configurations. The S interface is an implementation matter.

The particular terminal adaptation functions used are those detailed in 3G TS 27.002for non-transparent bearer capability. The interface to the MT2 used is according to ITU-T Recommendation V.24 with an option for support of 3G TS 27.007 procedures for auto calling and auto answering.

## 5.1 Fax adaptor functionality

The fax adaptor block, figure 3/23.146, is intended to specifically complement the facsimile group 3 terminal in order to be able to communicate over a UMTS PLMN.

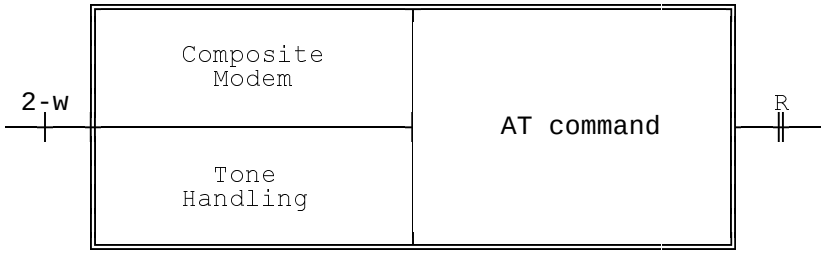


**Figure 3/23.146: Fax adaptor scheme**

Whether it has to be a function internal to the UMTS PLMN, or an external accessory associated with the facsimile group 3 terminal, is beyond the scope of this specification, and in any case, does not affect the working of the procedure as described here.

It may be functionally partitioned in two sections:

- an analogue section, dealing with:
  - the modulation and demodulation processes according to ITU-T Recommendation V.21, V.27ter, V.29 and V.17 as explained in ITU-T Recommendation T.4 and T.30;
  - handling of the signalling on the 2-wire path to the associated facsimile terminal, including auto calling and auto answering functions where necessary (see clause 8).
- a digital section, dealing with:
  - overall control of the adaptor;
  - where necessary, manipulating the ITU-T Recommendation T.30 protocol as detailed in this specification;
  - connection to the TAF using the interface according to ITU-T Recommendation V.24 as described in 3G TS 27.002;
  -
  - where necessary, auto calling and auto answering functions according to 3G TS 27.007.

## 5.2 UMTS facsimile machine functionality

The special UMTS facsimile machine shown in the UE configuration of figure 2d/23.146 is similar to the digital part of the fax adaptor, but without any of the analogue portions.

It appears at the ITU-T Recommendation V.24 interface as identical as the fax adaptor, i.e. the MT2 needs to have no knowledge of the particular configuration used.

# 6 Connection types

In UMTS, following connection elements attributes applicable to these Teleservices.

Connection element: Non-transparent
Duplex Mode: Full Duplex
Synchronous/Asynchronou: Asynchronous
Fixed Network User Rate: 14400 or 9600[bit/s]
Wanted Air User Rate: 28800 or 14400[bit/s]

Layer 1 at R interface conforms to 3G TS 27.002. Layer 2 at R interface (Layer2 protocol between FAXadaptor and TAF) is not specified in 3GPP.

To support the ITU-T Recommendation T.30, requiring different transmission rates, the following strategy shall be implemented:

- the channel on the radio interface in UMTS shall be a full rate channel that is satisfied with the user rate of 28800bit/s or 14400bit/s;
- no modification procedure (Channel Mode Modify: CMM) shall be performed during the data phase of the call;
- the transmission rate between the fax adaptor and the associated facsimile terminal at both ends shall be the same, i.e. there will be only one common end-to-end transmission rate at any given time;
- the negotiation of the message speed shall be end-to-end between the two TAFs; this allows also for a message speed of 2400, 4800, 7 200, 9600, or 12000, 14400bit/s to be used;
- the connection between the fax terminals is divided into five logical sections (T-FAX -(1)- T-adaptor-(2)-T-TAF -(3)- R-TAF-(4)-R-adaptor-(5)-R-FAX);
- flag stuffing is applied by the TAF towards the associated facsimile adaptor within the constraints of ITU-T Recommendation T.30, to keep the data link active whenever a procedure delay occurs;
- the BCS protocol elements and the facsimile coded data are buffered at both ends of the radio interface (in the TAFs), if necessary, to guarantee data integrity;
- a specific fax adaptor protocol (FA protocol) is provided between both the TAFs to cater for the appropriate link control.

## 6.1 Protocol model

Figure 5/23.146 depicts the protocol stack for this Teleservice.

It should be noted that depending on the particular implementation the R reference point may not explicitly exist. In this case the Layer2 protocol between FAXadaptor and TAF and consequently the Layer2 protocol between FAXadaptor and TAF entities operating across this interface may be omitted. The protocol stack at the radio interface, however, is not affected by this consideration, i.e. RLP and L2RCOP always apply.

The main point to be underlined is that all the protocol modules specific for this Teleservice are confined in the fax adaptor functions at both the UE and MSC/IWF ends. This includes protocol between FAXadaptor and TAF entity function to be operated towards the standard TAF for asynchronous non-transparent bearer capability.

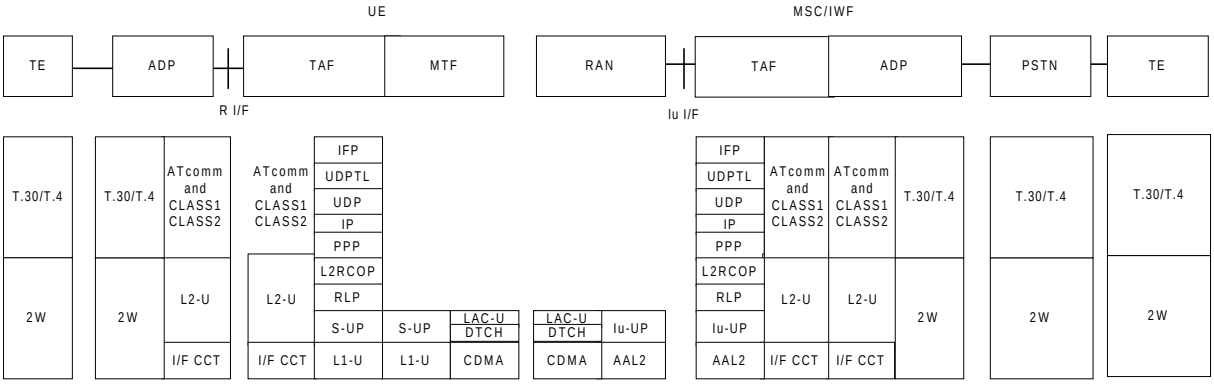


**Figure 5/23.146: Protocol stack for non-transparent support in UMTS**

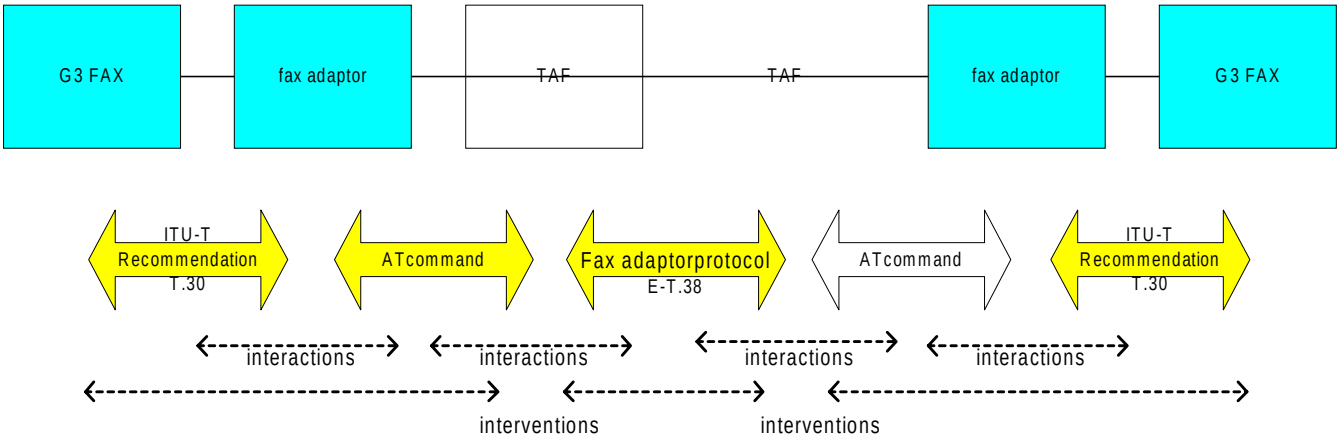


**Figure 6/23.146: Communication model**

## 6.2 Mobile to mobile calls

Tandem operation is applied to mobile to mobile calls. Support of tandem free operation is F.F.S.

## 6.3 Procedure interrupts

Procedure interrupts are only supported in Teleservices 61; in case of Teleservice 62 any attempt to invoke procedure interrupts by MMI on the MT (see subclause 6.4 below) will have no effect.

## 6.4 Radio channel modification

This applies to Teleservice 61 only, if a change of the radio channel during the call swapping from speech to facsimile or vice versa is required. For this purpose the in-call modification procedure (ICM) as detailed in 3G TS 24.008 is carried out.

The change from speech to facsimile is initiated by MMI at the facsimile terminal as in other data services starting the ICM procedure via MODIFY signalling . As a basic requirement for this transition, circuit 108.2 (according to ITU-T Recommendation V.24) towards the MT must be in the ON condition.

Additionally the data call direction (DCD) shall be known to both the FAs because of a correct tone handling. The DCD identifies the call direction from the calling to the called station according to ITU-T Recommendation T.30 phase A tonal signals. The DCD is derived from the evaluation of the behaviour of the mobile fax machine. No later than 3 sec after connecting the fax apparatus to the line the FA/UE is able to determine the DCD. If a CNG tone or nothing is detected by the FA/UE the mobile fax station is the calling station, if a CED tone or a BCS signal is detected by the FA/UE the mobile fax station is the called station. The FA indicates this towards the TAF by means of CT105: CT105 in OFF condition indicates "mobile terminated", whereas CT105 ON indicates "mobile originated". The detection of the CT105 condition and subsequent triggering of the MODIFY message has to be done 3 sec after the reception of the ON condition of CT108.2.

A reverse DCD compared with the initial call setup direction is indicated to the TAF/IWF by means of the "Reverse Call Setup Direction (RCSD)" IE within the MODIFY message. If the MODIFY message has contained this IE, the same IE shall be included in the MODIFY COMPLETE (ACK) message. On the basis of RCSD and additional information about the initial call setup direction (e.g. transaction identifier flag - ref. 3G TS 24.007), the TAF/IWF shall resolve the actual DCD.

At DCD condition "mobile originated" the FA/TAF has to transmit a CNG tone if neither CED nor a BCS signal has been already received, otherwise nothing. At DCD condition "mobile terminated" the FA/TAF has to transmit a CED. At the moment when CT107 goes to ON condition the FA/TAF has to generate CED if CT105 was in ON condition, otherwise nothing (see subclauses 8.2.1.1 and 8.2.2.1).

If during the facsimile call the return to speech is necessary (T.30 procedure interrupt request), this shall be initiated by the mobile fax machine as well as by the fixed network fax machine (ref. to the diagrams in figure II.14/15). Upon receipt of the alert operator tone the request will be accepted by manual intervention via MT (phone off-hook) and is reflected to the TAF/IWF by CT106 and CT109 going to OFF condition. Upon monitoring the transit of the necessary sequence of BCS signals specific for PRI the CT108.2 goes to OFF condition causing ICM from the fax data phase to the speech phase.

During the speech phase of a procedure interrupt, the phone off-hook condition of the MT is reported via the FA/TAF R-I/F (CT106/109 in OFF condition) to the fax apparatus which shall remain functionally connected to the fax adaptor to maintain the connection.

A subsequent reverse change to facsimile phase is also carried out by manual intervention at the MT causing ICM. This will be immediately reflected by circuit 107 going to OFF condition. The successful completion of ICM is indicated towards the FA/TAF by circuit 107 going to ON (provided circuit 108/2 is still in the ON condition).

During the speech phase of a procedure interrupt, the condition of the facsimile terminal of the UE is not reported across the ITU-T Recommendation V.24 interface. It may remain functionally connected to the fax adaptor, but in a suspended state.

The precise operation of the fax adaptor for the support of procedure interrupt is implementation dependent.

# 7 Facsimile adaptor

## 7.1 Principles of the Facsimile Protocol Adaptation

The basic approach of this specification for facsimile group 3 is:

- to convert the T.30 procedure from the associated facsimile to AT commands Class1 or Class2 and transmit them to the associated TAF;

- to check the message speed; the R-adaptor selects the appropriate modem indicated by DIS/DTC frames from R-FAX. The T-adaptor switches the appropriate modem according to TSI/DCS frames from R-FAX after selecting the modem indicated by DIS/DTC frames packets from the R-adaptor.

Following this strategy, an interchange model is defined concentrating on the facsimile relevant components. According to this model three connection sections may be distinguished:

a) between fax adaptor and associated facsimile terminal;

b) between the both fax adaptors and again;

c) between fax adaptor and associated facsimile terminal.

The fax adaptors will also shall cater for the correct establishment and control of these layers including traffic channel synchronization and status information exchange in particular with respect to circuit 106 and circuit 109 (according to ITU-T Recommendation V.24). Once these circuits have been set to ON (traffic channel synchronization), they shall be kept in the ON condition during the entire facsimile phase of a connection (refer subclause 6.3 "Procedure Interrupts").

### 7.1.1 Interactions within the fax adaptors

Interactions within the fax adaptors are necessary:

- where protocol packets may not be passed due to the differences between the PSTN and the UMTS PLMN;
- where the content of protocol packets shall be aligned with the capabilities of the supporting UMTS PLMN;
- The hardware flow control of V.24 is adopted for the flow controll between adaptor and TAF

To perform the necessary interactions the fax adaptors both in the MS side and in the MSC/IWF side shall monitor the BCS frames and the facsimile coded data exchanged between the two facsimile terminals and to act as detailed below:

- control of the half duplex connections between the fax adaptor and the associated facsimile terminal;
- relay of the ITU-T Recommendation T.30 protocol elements between the two facsimile terminals by using the appropriate AT commands Class1 or Class2;

To regenerate the original ITU-T Recommendation T.30 protocol element the actions shall be reversed at the remote fax adaptor.

The support of guard tones by the fax adaptor in the MSC/IWF is an implementation option.

# 8 Use of terminal adaptation functions

The protocol stack of the connection types are shown (figure 5/23.146).

The TAFs are those described in 3G TS 27.002 for asynchronous bearer capabilities in the non-transparent mode. The interchange signalling mapping is in accordance with 3G TS 27.002.

## 8.1 Principles of terminal adaptation functions

Integral part of an end-to-end connection for this Teleservice is the fax terminal adaptation function, located at both the PLMN ends and in charge of:

- establishment and maintenance of a Layer2 protocol link between fax adaptor and TAF according to 3G TS 27.002, where applicable;
- establishment and maintenance of an L2RCOP link between the TAFs according to 3G TS 27.002;
- transcoding of the document content to be transmitted across the radio interface as described in clause 8 of this specification;

The basic approach of this specification for facsimile group 3 is:

- to use the network support (BS 20,NT) as basically defined in technical specifications 3G TS 27.001, 27.002 and 29.007;
- to use the ITU-T Recommendation T.30 procedure at both ends of the connection between the fax adaptor and the associated facsimile terminal and to use the AT commands Class1 or Class 2 at both ends of the connection between the fax adaptor and the associated TAF.;
- to use a specific protocol (E-T.38) between both the TAFs across the radio interface. E-T.38 is based on ITU-T Recommendation T.38, but there are some differences about the packet elements, transcoding methods, and the procedure of controlling signals. And the same procedure as T.38 is used about the structure of the frame and the protocol stack (Refer to the following clause, Annex A and T.38 for the details.)
- to intervene within the TAFs in order to avoid T.30 timer timeout due to the delays in the radio interface.

## 8.2 Specific TAFs for facsimile service

Basically there are four problem areas:

- support of facsimile group 3 with a digital connection type;
- unpredictable delays on the radio interface due to actual RLP working conditions (ARQ);
- the need to change the transmission rate "locally" in the fax adaptors both in the UE and in the MSC/IWF and to adapt it to the constant user rate of the TAF;
- the inability to support some ITU-T Recommendation T.30 features.

To overcome these problems some particular functions within the TAFs are necessary, such as:

- buffering of BCS frames and facsimile coded data prior to transfer;
- autonomous interventions such as BCS command inhibiting within the TAFs;
- autonomous interactions between any TAF and the associated fax adaptor such as AT command (command/response repetition); and
- provision of a fax adaptor protocol (IFP/UDPTL/UDP/IP/PPP)as interchange protocol between the TAFs.

The main features relevant to the ITU-T Recommendation T.30 adaptation functions are detailed in the following.
For better clarification only, in the following a double configuration will be referenced:

- transmitter adaptation function, established at the PLMN side where the terminal is located actually performing document transmission;
- receiver adaptation function, established at the PLMN side where the terminal is located actually receiving the facsimile document.

The proper configuration is settled on both network sides by detecting DIS/DTC frame just at the beginning of the phase B in the ITU-T Recommendation T.30 protocol procedure.

The optional error correction mode, as defined in ITU-T Recommendation T.4-Annex A and ITU-T Recommendation T.30-Annex A may be fully supported, provided some specific features are included in the fax adaptor procedure.

These features are relevant to:

- additional BCS frames to be detected;
- handling of the message phase.

The overall framework as described in clause 8 of this specification applies, i.e. also the procedures of the error correction mode are, in principle, run between the T-FAX and the T-TAF, theT-TAF and the R-TAF, and the R-TAF and the R-FAX.

The error correction mode is entered upon detection of the relevant bits in the DIS/DTC frame.

The working principle of this specification is based on the detection, control, deletion, and generation of key messages between the T-FAX and the T-TAF, the T-TAF and the R-TAF, and the R-TAF and R-FAX.

While in BCS phases, the following frames shall be detected:

- DIS/DTC, to monitor all operational parameters of the transmitting terminal;
- CSI, to monitor all operational parameters of the receiving terminal;
- DCS, to realize the actual operational parameters, e.g. message transmission speed accepted by the sender terminal and the relevant message transfer direction (see table 2/ITU-T Recommendation T.30);

- TSI, to indicate that the following FIF information is the identification of the transmitting terminal. It may be use to provide additional security to the facsimile procedures;
- TCF, to verify training and to give a first indication of the acceptability of the channel for this data rate;
- FTT, to reject the training signal and requesting a retrain;
- CTC/EOR, fixing the retransmission strategy by the facsimile transmitting terminal (error correction mode);
- CTR/ERR, acting as confirmation message and so closing a BCS phase before a new message phase;
- EOM, to indicate the end of a complete page of facsimile information and to return to the beginning of the phase B;
- MPS, to indicate the end of a complete page of facsimile information and to return to the beginning of the phase C upon receipt of a confirmation;
- EOP, to indicate the end of a complete page of facsimile information and to further indicate that no further documents are forthcoming and to proceed to phase E, upon receipt of a confirmation;
- PRI-Q, to indicate the same as EOM/MPS/EOP command with the additional optional capability of requesting operator intervention, therefore PRI-Q is treated as EOM/MPS/EOP;
- NSF, to indicate the specific user requirements, which are not covered by T-Series Recommendations, however this signal is not transmitted to the radio network;
- NSC, to indicate the response to NSF, however this signal is not transmitted to the radio network;
- CFR and MCF, to trigger the message phase, however this signal is not transmitted to the radio network;
- PPR, as above, but after the fourth consecutive PPR request, the BCS phase continues with either CTC or EOR (error correction mode), however this signal is not transmitted to the radio network;
- RR, to ask for the status of the receiver however this signal is not transmitted to the radio network;
- RTP, to indicate that a complete message has been received and that additional message may follow after retransmission of training and CFR, however this signal is not transmitted to the radio network;
- RTN, to indicate that the previous message has not been satisfactorily received. However, further receptions may be possible, provided training is retransmitted, however this signal is not transmitted to the radio network;
- PIP/PIN, to indicate that further transmissions are not possible without operator intervention, therefore this signal is not transmitted to the radio network as PIP/PIN packet, however this signal is not transmitted to the radio network;
- RNR, to indicate that the receiver is not ready to deceive more facsimile data, however this signal is not transmitted to the radio network;
- ERR, to indicate the response to EOR, however this signal.is not transmitted. to the radio network;
- DCN, to initiate the call release procedure.
- CRP, to require the retransmission of the previous received signal in errors however this signal.is not transmitted. to the radio network;

Furthermore, all BCS command messages shall be monitored to eliminate repeated command messages at the TAF and to initiate a repetition of those command messages, if necessary, at TAF. Additionally, all BCS response messages shall be monitored to be able to clear the former condition.

### 8.2.1 Packet elements between TAFs

To cater for the appropriate facsimile transmission some protocol elements and their use (procedure) are defined. These protocol elements are exchanged between both TAFs. They are based on T.38 or E-T.38 and described as follows and are structured as outlined in annex A:

-IFP packet:

The IFP packet is used to relay ITU-T Recommendation T.30 BCS frames. It includes the possibility also to transmit parts of an entire BCS frame (segmentation).

-T.30_INDICATOR

- CNG packet
- CED packet
- TCF error detection packet:

The TCF error detection packet is used to inform the opposite TAF of the TCF error.

- DCN transmission confirmation packet:

DCN transmission confirmation packet is used to indicate the R- TAF informs the T- TAF that

the R- TAFtransmitted DCN to the R-adaptor / FAX.

-T.30_DATA

- T.30_DATA conforms to T.38.(ref. annex A)

-Defined in T.38 but not used packets in this specification. (ref. annex A)

- Training packet
- V.21 Preamble Flags packet

### 8.2.2 Interactions and interventions within the TAFs

Interactions and interventions within the TAFs are necessary:

- where the content of protocol packets shall be aligned with the capabilities except NSF,NSC of the supporting

  UMTS PLMN;

- where BCS commands shall be repeated autonomously by the TAF after a time-out when no response has been received from the associated FA/facsimile terminal;
- where the retransmission of IFP packet(s) rely on the control of the error re-transmission in RLP;
- where the retransmission of BCS commands is requested by the associated FA/facsimile terminal sending a CRP frame due to recognized transmission errors;
- during the transmission of facsimile coded data where the document content is transcoded to save transmission capacity at the radio interface (however, this does not apply when using the ITU-T Recommendation T.30 error correction mode);
- Flow control between the T- TAF and the R- TAF is started at the time when the connection of L2RCOP is established and finishes when the connection of L2RCOP is released;
- The TAF distinguishes the state of the opposite TAF by using the busy flag in the transmission and reception frame;

- If the facsimile data accumulation value of the R-TAF is 0.28kbyte or more during phase C, R-TAF keeps the busy flag ON by the X bit in L2RCOP status octets, that is, the flow control between both TAFs is practiced by using the X bit in L2RCOP status octets until phase D;

- The flow control is used to avoid that the phase at the T-TAF proceeds the next phase (as a result of EOP, MPS, EOM, CTC, PPS-Q, EOR-Q, RR) while the R-TAF is still busy in the current phase;

To perform the necessary interactions and interventions the TAFs both in the MS and in the MSC/IWF shall monitor the AT commands Class1/Class2 and the facsimile coded data exchanged between the two facsimile terminals and to act as detailed below:

- reception of ITU-T Recommendation T.30 BCS protocol elements from the associated FA/facsimile terminal discarding BCS commands (AT commands) repetitively received due to time-out in the facsimile terminal;

- transmission of ITU-T Recommendation T.30 BCS protocol elements to the associated FA/facsimile terminal autonomously repeating BCS commands (AT commands) towards the accepting facsimile terminal if necessary after time-out or on request by CRP;

- storage of BCS commands/responses (AT commands) completely received from the associated FA/facsimile terminal;

- relay of the ITU-T Recommendation T.30 protocol elements between the two FA/facsimile terminals by using the appropriate FA protocol (IFP/UDP/UDPTL/IP/PPP) elements and mapping on to the particular L2R protocol (L2RCOP) elements and vice versa as indicated below;

- changing information elements of the BCS frames indicating capabilities which maynot be supported by the PLMN;

- transmission/reception of the ITU-T Recommendation T.30 training check frames (TCF) to/from the associated FA/facsimile terminal;

- phasing/training with the associated FA/facsimile terminal;

- transcoding of the normal facsimile coded data received from the FA/facsimile terminal and writing them into a buffer in the TAF associated with the transmitting FA/facsimile terminal;

- reading of the facsimile coded data from the buffer for transmission across the radio interface using the appropriate FA protocol packets;

- writing of the facsimile coded data received across the radio interface into a buffer at the receiving end of the connection section between T-TAF and R-TAF;

- reading and reverse transcoding of the buffered normal facsimile coded data and transmitting them to the associated FA/facsimile terminal;

- control of a response transmission timer, to guarantee the reception of a response right in time (refer to subclause8.2.3.1).

- transmit the dummy signal to the FA/facsimile terminal in order to avoid T.30 timer time-out at the turn of phases.

- adjusting of the time interval.

- If the facsimile coded data in the memory of the TAF is over the busy threshold of the TAF, the T- TAF indicates busy flag on.

The algorithm for mapping the AT commands Class1 or Class2 information onto the L2R protocol elements consists of two steps:

- generation of the appropriate FA protocol element according to the received AT commands Class1/Class2 or facsimile coded data;

- generation of a single L2RCOP I-frame including the FA protocol element in the information field;

## 8.2.3 BCS phase

### 8.2.3.1 BCS command/response procedures

The ITU-T Recommendation T.30 procedure is segmented in sections of associated BCS commands and responses. Any command sent by a facsimile terminal shall be answered by an appropriate BCS response (refer to Appendix III, ITU-T Recommendation T.30). To guarantee that transmission and reception of responses take place right in time, the response time after reception of previous command is fixed when the opposite TAF is not busy. On the other hand, the interval is to be long when the opposite TAF is busy. According to the command/response relationship, the TAF receiving a BCS command from its associated facsimile terminal is further on designated as commanding TAF. Similarly, the TAF receiving a BCS response is called the responding TAF. The procedure is as follows:

The TAF should not transmit the preamble from the associated FAX to the radio network, and the TAF records the BCS command from the radio network and transmits the preamble and procedure signal to the associated FA/facsimile within the proper timing.The commanding TAF starts forwarding the received BCS command using "IFP packets" A BCS command which has been received correctly from the associated FA/facsimile terminal (condition 2), is stored within the commanding TAF. If condition 2 applies, any forwarding of BCS commands repetitively received from the FA/facsimile terminal is further on inhibited. If an error occurs during the reception of the BCS command from the associated FA/facsimile terminal, the commanding TAF should re-transmit the previously transmitted procedure signal to the associated FAX and request the proper procedure signal. The commanding TAF should not transmit the incorrect procedure signal received from the associated FAX to the radio network.

The responding TAF receiving "IFP packets" checks their correct sequence and starts reassembling and transmitting the BCS command once a complete BCS frame or is received from the commanding TAF and no sequence error has been detected. Any "IFP packet" received after successful reception of a complete BCS command is ignored. The sequence has to be reconstituted at the responding TAF when sending to the associated FA/facsimile terminal. If necessary, flags are transmitted between the BCS frames.

The retransmission of error partial IFP packet(s) is relying on the control of the L2 ARQ in RLP

Contiguously received parts of a BCS command packet received from the radio interface are stored in the responding TAF. The stored BCS command when completed, is used for autonomous retransmissions towards the associated FA/facsimile terminal which may start at the earliest possible time according to ITU-T Recommendation T.30. No repetition counter is provided.

A BCS response which has been received correctly from the associated FA/facsimile terminal (condition 2), is stored within the responding TAF.

If an error occurs during the reception of the BCS response from the associated FA/facsimile terminal, the responding TAF should re-transmit the previously transmitted procedure signal to the associated FAX and request the proper procedure signal. The commanding TAF should not transmit the incorrect procedure signal received from the associated FA/facsimile to the radio network.

The commanding TAF receiving "IFP packets" checks their correct sequence and starts reassembling and transmitting the BCS response once a complete BCS frame is received from the responding TAF and no sequence error has been detected. Any "IFP packet" received after successful reception of a complete BCS response is ignored. The sequence has to be reconstituted at the commanding TAF when sending to the associated facsimile terminal. If necessary, flags are transmitted between the BCS frames.

The retransmission of error partial IFP packet(s) is relying on the control of the L2 ARQ in RLP.

Contiguously received parts of a BCS response received from the radio interface are stored in the commanding TAF. The stored BCS response when completed, is used for autonomous answering towards the associated FA/facsimile terminal which may start at the earliest possible time according to ITU-T Recommendation T.30.

After transmission of a response towards the FA/fax apparatus by the TAF function, after which the TAF function waits for message data (CFR, CTR, MCF after MPS, PPS_MPS, PPS_NULL, ERR after EOR_MPS, EOR_NULL) a repeated BCS command shall be locally responded, without transferring a preamble element towards the radio link.

The TAF/FAs shall take care of the control of the local modem. The condition is derived from the reception of certain fax adaptor protocol elements. Additionally, there shall be a control of the half duplex transmission path towards the associated facsimile terminal. For that purpose, the receiver signal is monitored and the transmitter is only activated, if no receive signal is active.

### 8.2.3.2 Compatibility checking

Some features shall not be supported in the UMTS PLMN environment. The TAF is in charge of dealing with such compatibility checking which is carried out by monitoring certain BCS frames (DIS/DTC).

- Group 1 and group 2 equipments shall not be supported by the Teleservice as described in this specification.
- Error limiting mode shall not be supported.
- Only standard 300 bit/s Binary Coded Signalling shall be supported. To this purpose the fax adaptor will ignore the 2400 bit/s capability within the phase B of the ITU-T Recommendation T.30 procedure by looking for DIS frames from ITU-T Recommendation V.21 modem only.
- Only facsimile message speeds up to and including 14400 bit/s shall be supported. For this purpose the fax adaptors are responsible to carry out appropriate actions, e.g. to set the applicable fields in the DIS frame accordingly.
- It is not possible to support non-standard facilities since some of these contain proprietary methods of changing the modem speed, invisible to the IWF and hence impossible to track.

### 8.2.3.3 Training Check

The training check sequence (TCF) as per ITU-T Recommendation T.30 is exchanged only locally between the TAF and the associated FA/facsimile terminal. The training check sequence sent by the TAF shall have the minimum duration permitted (ref. to ITU-T Recommendation T.30). Because the CFR is not the signal transmitted between end-end the T- TAF selects the signal (CFR, FTT), that should be sent to the T-FAX, by using the flow control function to monitor the state of the R-TAF. The training check sequence sent by the TAF shall have the minimum duration permitted (ref. to ITU-T Recommendation T.30).

As a consequence of this local procedure, the TAFs shall check the received TCF whether the quality requirements are satisfied. Depending on the result of that check, the TAF recognizing a bad line will eventually change the CFR to be a FTT. If the T- adaptor receives incorrect TCF from the T-FAX, it transmits the TCF error detection packet to the R- TAF. On the other hand, if the R-TAF receives the TCF error detection packet from the radio network, it transmits the TCF error to the R-FAX.

With the knowledge of the TCF check result of the opposite TAFand the received response frame (CFR or FTT) from the fax apparatus, the TAF, which generated the TCF, is able to deduce the following phase.

The message transfer phase in the receiving TAF is entered upon reception of TCF packet TCF_OK and CFR. The modem training at transmission speed shall start if R-TAF receives the facsimile coded data within Ts after the receipt of CFR from the associated FA/facsimile terminal.

In the other cases, the transmitting TAF shall repeat the last DCS/TCF sequence 3s after reception of the response, if no new DCS frame from the opposite TAF is available.

The T-TAF transmits the TCF error detection to the R-TAF if TCF transmitted by the T-FAX is incorrect, whether the call was mobile to mobile call or mobile to fixed.

The R-TAF transmits the TSI, DCS to the R-FAX, if it may not receive the facsimile coded data within Ts after the receipt of the CFR from the R-FAX.

#### 8.2.3.4 Control of transmission rate

The controlling entity of the TAF recognizes when a change of the transmission rate - and in conjunction with this a change of the modem function - has to commence. The transmission rate is then changed only locally, i.e. between the facsimile terminal and the TAF at both the MSC/IWF and the UE ends.

The actual message speed and the modem function are derived from the content of the related BCS frames (DIS/DTC, DCS, CTC).

### 8.2.4 Message phase

During the message phase (phase C of ITU-T Recommendation T.30) a single bit pattern has to be detected, the EOL character (see subclause 4.1.2/ITU-T Recommendation T.4), a unique code word that may never be found within a valid line of facsimile coded data, and is used, as per ITU-T Recommendation T.4:

- to identify the start of message phase;
- to control the buffer level;
- to mark the end of message phase (6 consecutive instances).

#### 8.2.4.1 Message Transcoding

To save transmission capacity at the radio interface the content of the document shall be transcoded. This applies only, when using the normal facsimile data transfer, i.e. not with the error correction mode.

The facsimile coded data received by the TAF from the facsimile terminal is transcoded and transmitted to the corresponding TAF across the radio interface, where it is transcoded in the reverse direction and transmitted to the receiving facsimile terminal.

The transcoding is based on the minimum line length capability of the T.30 protocol for the normal facsimile data transfer. According to this the transmitting facsimile terminal has to fill up each coded scan line with FILL information to conform to this requirement (ref. ITU-T Recommendation T.4).

To take advantage from that, the TAF associated with the transmitting facsimile terminal will force this to use (at least) the standard value of 20 ms by replacing the applicable parameter value of the exchanged DIS/DTC messages. All FILL information of the facsimile coded data received from the facsimile terminal will be deleted prior to forwarding the data across the radio interface. The TAF associated with the receiving facsimile terminal shall recognize and store the originally requested minimum line length to be able to regenerate to correct line length.

It should be noted that the ITU-T Recommendation T.4 document coding may be 1-dimensional or 2-dimensional and, in addition, uncompressed. The TAFs shall take care of this when transcoding the document content.

#### 8.2.4.2 Generation of the normal data packet

This is specified in T.38, X.691, referenced in T.38 provide details for octet alignment.

#### 8.2.4.3 Generation of the error correction data packet

This is specified in T.38, X.691, referenced in T.38 provide details for octet alignment.

### 8.2.4.4 Normal facsimile data

The T-TAF starts the message phase by transmitting CFR or MCF to the T-FAX. The R-TAF enters the message phase by receiving CFR or MCF from the R-FAX.

- If the R-TAF might not receive the facsimile coded data within 3s from the radio network after receiving CFR from the R-FAX, it re-transmits a preamble of 1.0s and the previously transmitted TSI, DCS to the R-FAX after changing the modem to V.21.
- If the R-TAF might receive the facsimile coded data within 3s from radio network after receiving CFR from the R-FAX, it transmits the training to the R-FAX after changing the modem to V.17, V.27ter or V. 29.
- If the R-TAF might not receive the facsimile coded data within 3s from the radio network after receiving MCF from the R-FAX, it re-transmits a preamble of 1.0s and the previously transmitted MPS to the R-FAX after changing the modem to V.21.
- If the R-TAF might receive the facsimile coded data within 3s from the radio network after receiving MCF from the R-FAX, it transmits the training to the R-FAX after changing the modem to V.17, V.27ter or V. 29.

Following the training segment, 0s bits will be stuffed towards the facsimile terminal (FILL sequence, see subclause 4.1.2 of ITU-T Recommendation T.4), disregarding all information received from the radio interface, until a EOL character is detected, that will mark the beginning of the real phase C (see figure 1/ITU-T Recommendation T.4).

If due to a preceding error the message phase may not be entered, this training shall be aborted when a new IFP packet is received by the transmitting fax adaptor.

### 8.2.4.5 Error correction facsimile data

As these facsimile coded data between the fax adaptor and the facsimile terminal are structured in HDLC frames, the handling of this procedure segment will exploit such formatting. The content of such an HDLC frame is further on called a block.

Each such block is included in the information field of a error correction data packet of the FA protocol which is processed for transmission across the radio interface as outlined in clause 6.

The message phase (see figure II.8/23.146) at both the PLMN ends is triggered by the transit of a confirmation frame (CFR, MCF, PPR, CTR or ERR) sent by the receiving terminal and marking the end of the BCS phase.

The PPR that the TAF sends to the associated FAX means the following process.

- PPR is used to request re-transmission of the facsimile coded data. When the TAF receives error facsimile coded data, it requests correct facsimile coded data to the associated FAX. (T.30 Recommendation)
- PPR is used to avoid the timer timeout of the T.30 protocol.
  If the TAF are busy, The T-TAF should transmit PPR to the T-FAX.

If four consecutive PPR are counted within the same "partial page", the BCS phase continues.

The transmitter adaptation function will enter the message phase as per ITU-T Recommendation T.30 standard procedure.

- If the R-TAF might not receive the facsimile coded data within Ts from the radio network after receiving CFR from the R-FAX, it re-transmits a preamble of 1.0s and the previously transmitted TSI, DCS to the R-FAX after changing the modem to V.21.

- If the R-TAF might receive the facsimile coded data within Ts from radio network after receiving MCF from the R-FAX, it transmits the training to the R-FAX after changing the modem to V.17, V.27ter or V. 29.
- If the R-TAF might not receive the facsimile coded data within Ts from the radio network after receiving MCF from the R-FAX, it re-transmits a preamble of 1.0s and the previously transmitted MPS to the R-FAX after changing the modem to V.21.
- If the R-TAF might receive the facsimile coded data within Ts from the radio network after receiving MCF from the R-FAX, it transmits the training to the R-FAX after changing the modem to V.17, V.27ter or V. 29.

Following the training segment, HDLC flags will be stuffed towards the facsimile terminal until a FCD frame is detected, that will mark the beginning of the real phase C.

If due to a preceding error the message phase may not be entered, this training shall be aborted when a new IFP packet is received by the transmitting fax adaptor.

#### 8.2.4.6 Controlling of facsimile coded data

The procedure of controlling FAX data with TAF is described in the following subclause.

The buffer size inside TAF is recommended more than 256kbytes.

##### 8.2.4.6.1 Transmitter TAF

In the T-TAF the facsimile coded data being received from the facsimile terminal are transcoded stripping of FILL information and written into the buffer.

If there is enough information available, this data is read out from the buffer, and a FA protocol element is generated which is processed as described in clause 8 to be transferred to the receiver adaptation function using one of the standard TAFs referred to in subclause 8.1. For that purpose the data is segmented in blocks (see subclause 8.2.4.2).

Due to the ARQ techniques of the RLP the throughput across the radio interface may be less than the message speed between the transmitting facsimile terminal and the transmitter adaptation function, i.e. the content of the buffer may increase. The TAF has the plenty of buffer size withstand the usually considered delay.

If the throughput at the radio interface is greater than the message speed between the transmitting facsimile terminal and the transmitter adaptation function (e.g. when the end-to-end speed is lower than 14400 bit/s), the buffer may be empty most of the time.

##### 8.2.4.6.2 Receiver TAF

In the R-TAF FILL information is transmitted to the facsimile terminal at the beginning of each page, if necessary, to bridge the gap between the training sequence and the real facsimile coded data. In case of normal fax data the FILL 0's may be expanded up to 4.5s only

The facsimile coded data received across the radio interface are re-generated from the Layer2 protocol between FAXadaptor and TAF, L2R and FA protocol elements, reversely transcoded according to the knowledge of the fax adaptor, and written into the buffer. The reverse transcoding consists of insertion of FILL information before the facsimile coded data is forwarded to the facsimile terminal to comply with the recognized minimum line length as defined in ITU-T Recommendation T.4.

At the beginning of each page the facsimile coded data to be sent to the facsimile terminal is not read out from the buffer until either at least 2 instances of EOL and the buffer size is 0.28kbytes or more have been received, an RTC have been received, which does not depend on the end-to-end data transfer rate, has been exceeded.

- Fill insertion method for NON- ECM

The R-TAF controls FILL insertion according to the accumulation value of image signals.

- The condition for starting FILL insertion

  - When the pix memory accumulation value is 0.28kbytes or less.

- The condition for stopping FILL insertion

  - When the pix memory value is 0.9kbytes or more.

  - When the pix memory value is not over 0.9kbytes and the interval between EOLs (one line period) reaches 4.5s, the R-TAF stops FILL insertion, and transmit EOL and start to the next facsimile coded line. (“Image signal memory fill insertion control” will start again)

- Control algorithm for image signal reception side facsimile (without transmitted image signal to the R-FAX)

After inserting FILL information for 4.5s, when the value of the transmitted image signals to R-FAX is below the level of “the forced RTC transmission value”(=7byte or less), the R-TAF will send RTC to the reception side facsimile to force end of Phase C. Then it will wait for a post-message (EOP,EOM,MPS) received from the air interface.

- Flag insertion method for ECM

The R-TAF controls FLAG insertion according to the accumulation value of image signals.

- The condition for starting Flag insertion

  - When pix memory accumulation value is 0.28kbytes or less.

- The condition for stopping Flag insertion

  - When the pix memory value is0.9kbytes or more.

### 8.2.5 Disconnect procedure

The transmitter adaptation function, upon detection of the DCN frame (see ITU-T Recommendation T.30) sent by the local terminal to indicate the end of the facsimile transmission, initiates the disconnect procedure. The TAF transmits the DCN packet to the remote TAF after receiving the DCN frame (see ITU-T Recommendation T.30) from the associated FA/facsimile terminal, while the remote TAF transmits the DCN confirmation packet to the other TAF and transmits the DCN frame (see ITU-T Recommendation T.30) to the facsimile after receiving the DCN packet.

### 8.2.6 Timeouts

The T.30 timer between the T-FAX and T-TAF and the T.30 timer between the R-FAX and R-TAF are independent of each other. Therefore, the overall fax adaptation function is in principle bound to the timing constraints associated with the associated FAX ITU-T Recommendation T.30 procedure.This means that, no matter of the reference configuration used at the mobile station, either the "standard" one (figure 2a/23.146) or the "UMTS facsimile machine" (figure 2d/23.146), the progress of the call will be mainly subject to the ITU-T Recommendation T.30 typical timing protections, settled externally.

However, due to the specific conditions caused by the UMTS PLMN system, there is the need for a special support with respect to BCS command repetitions as explained above. For that purpose, the fax adaptors will provide means for local time-out. The timer will be started and stopped as described in the applicable clauses of the ITU-T Recommendation T.30.

### 8.2.7 Performance constraints

In order to perform the procedures described in this specification the UE and the IWF environment should be designed to be able to transmit and receive facsimile data continuously with need to flow control the procedure by themselves. This applies specifically for the RLP, L2R (within TAF), and the flow control between fax adaptor and TAF entities within the UE or the IWF.

Furthermore, the RLP entity should be able to make error recovery by using the SREJ command/response. The parameters (timers, repetition counters, etc.) should be set to appropriate values using the negotiation capability of the RLP.

# 9 Signalling aspects

3G TS 27.002 identifies the bearer capability requirements to be supported by the terminal adaptation function in the MT (see 3G TS 27.001for BC and HLC coding). The specific signalling requirements are those for "speech" and "facsimile group 3" or "facsimile group 3" only, respectively. The MT indicates in the call set up request the requirements, e.g. first speech, second facsimile by sending the bearer capability information element(s) in the appropriate order. For an "auto calling" facsimile request, the facsimile group 3 bearer capability is sent as the first or the only bearer capability for Teleservice 61 or 62, respectively.

For interworking between Teleservice 61 and Teleservice 62 refer to GSM 02.03 and 3G TS 27.001.

## 9.1 Handling of tonal signals

Because the ITU-T defined service uses modems, there are some signals received from the analogue link at the MSC/IWF and (where used) the fax adaptor which do not have a direct binary representation. These signals maynot therefore be passed across the radio interface in the same way as the ITU-T Recommendation T.30 and ITU-T Recommendation T.4 information.

These signals are the modem called (CED) and calling (CNG) tones sent at the start of each fax data phase of the call; they are generated locally by the FA/UE and/or FA/IWF, exploiting an end-to-end time alignment mechanism, triggered by appropriate messages on the UMTS signalling channel. The procedure is detailed in the 3G TS 27.007.

## 9.2 Call establishment

### 9.2.1 Mobile terminated call

The PSTN facsimile group 3 terminal may be manually or automatically calling.

#### 9.2.1.1 Speech then facsimile

Refer to the diagram in figure II.1a/23.146 and II.1b/23.146. In both of the figures the initial call setup is mobile terminated. In figure II.1a23.146 the DCD is also mobile terminated (MT), while the DCD in figure II.1b/23.146 is mobile originated (MO).

In order to make the transition from the speech phase to the facsimile phase, the MODIFY command shall be initiated by MMI at the facsimile terminal.

In the case where a UMTS facsimile machine is used, it will turn on circuit 108/2 when it is connected to the line by manual intervention.After turning on circuit 180/2, a fax adaptor sends "ATA" to TAF according to 3G TS 27.007.

In the case where a fax adaptor at UE is used, it will turn on circuit 108/2, when the mobile fax apparatus is connected to the line by manual intervention.

After determination of the DCD and ICM (see subclause 6.4) and on completion of the synchronization process over the radio interface or the RLP establishment, CT107 shall be turned on by the MT; in case where a FA is used, on receipt of CT107 from TAF/UE, the FA will complete the tonal handshaking according to the rules in subclause 6.4.

The analogue link at the FA/IWF side will be established in accordance with the T.30 rec.; provided the synchronization process or the RLP establishment is completed (CT108.2 ON condition), the appropriate tone according to the rules in subclause 6.4 shall be transmitted. In case of DCD mobile terminated the CED tone shall be transmitted after a silence of 1.8 to 2.5 sec (see T.30, 4.3.3.2) from the call being answered; during transmission of CED tone (2.6 sec minimum duration, followed by a delay period of 75 +/- 20 ms) the FA/IWF will process data received from the UMTS-DTCH as usual, but relevant information (e.g. preamble of a BCS frame) shall be discarded without any buffering. Note that circuit 109 and circuit 106 (according ITU-TRecommendation V.24) at the R interface of the MT shall be turned on by the fax adaptor at the IWF before any further procedure may be carried out between the fax adaptors and consequently end-to-end. Once the connection is established, both circuit 106 and circuit 109 are clamped to the ON condition by the fax adaptor at the IWF, so fixing a full duplex mode throughout the whole facsimile phase of the call.

#### 9.2.1.2 Auto answer

Refer to diagram in figure II.2/23.146. A call received from the PSTN will cause the TAF/UE to send “Ring”(according to3G TS 27.007) at the R interface.

In the case where a UMTS facsimile machine is used, 3G TS 27.007 is handled directly by turning on circuit 108/2.

In the case where a fax adaptor is used, “Ring”will cause ring current to be sent to the mobile facsimile terminal. The fax adaptor will turn on circuit 108/2, when the mobile facsimile terminal answers the call.

After turning on circuit 108/2, a fax adaptor sends "ATA" to TAF according to 3G TS 27.007.

On receipt of circuit 108/2, the TAF/UE will answer the call and initiate the synchronization process and the establishment of the RLP across the radio interface. On completion of the synchronization process or RLP establishment, the modem at IWF will automatically be selected and send CED to PSTN facsimile terminal. Also circuit 107 shall be turned on by the MT.

In the case where a fax adaptor is used, on receipt of circuit 107 from TAF/UE, the fax adaptor will initiate the tonal hand-shake by sending CNG (option).The analogue links at both the PSTN side and the mobile side (where a fax adaptor is used) will be established in accordance with the appropriate V. series recommendation.

Note that circuit 109 and circuit 106 at the R interface of the TAF/UE shall be turned on by the fax adaptor at the IWF before any further procedure may be carried out between the fax adaptors and consequently end-to-end. Once the connection is established, circuit 109 is clamped to the ON condition by the fax adaptor at the IWF, so fixing a full duplex mode throughout the whole facsimile phase of the call.

## 9.2.2 Mobile originated calls

The PSTN facsimile group 3 terminal may be manually or automatically answered.

### 9.2.2.1 Speech then facsimile

Refer to the diagram in figure II.3a/23.146 and figure II.3b/23.146. In both of the figures the initial call setup is mobile terminated. In figure II.3a/23.146 the DCD is also MO, while in figure II.3b/23.146 the DCD is MT.

In order to make the transition from the speech phase to the facsimile phase, the MODIFY command shall be initiated by MMI at the TAF/UE, which will result in an establishment of the RLP across the radio interface and connection to line of the FA/IWF.

In the case where a fax adaptor is used, the mobile facsimile terminal shall be connected to line by manual intervention at this stage, and will cause the fax adaptor to turn on circuit 108/2 (according to ITU-TRecommendation V.24) towards the TAF/UE.

In the case where a UMTSfacsimile machine is used, circuit 108/2 shall be turned on when the UMTS facsimile machine is connected to line by manual intervention.After turning on circuit 180/2, a fax adaptor sends "ATD" to TAF according to 3G TS 27.007.

After determination of the DCD and ICM (see subclause 6.4) and on completion of the synchronization process across the radio interface or the establishment of RLP, the modem at the IWF will be automatically selected and send the appropriate modem tone according to the rules in subclause 6.4 to PSTN facsimile terminal. Also circuit 107 shall be turned on by the TAF/UE, whereupon the TAF/UE will complete the tonal handshaking according to the rules in subclause 6.4.

In the case where a fax adaptor is used, the receipt of circuit 107 shall cause the fax adaptor to connect to line.

The analogue links at both the PSTN side and the mobile side (where a fax adaptor is used) will be established in accordance with the appropriate ITU-TV. series recommendation.

Note that circuit 109 and circuit 106 at the R interface of the TAF/UE shall be turned on by the fax adaptor at the IWF before any further procedure may be carried out between the fax adaptors and consequently end-to-end. Once the connection is established, both circuit 106 and circuit 109 are clamped to the ON condition by the fax adaptor at the IWF, so fixing a full duplex mode throughout the whole facsimile phase of the call.

### 9.2.2.2 Auto calling

Refer to diagram in figure II.4/GSM 23.146. The auto calling procedure of 3G TS 27.007 ("ATD xxxx" ) is initiated at the ITU-T Recommendation V.24 interface. This is done either directly from the UMTS facsimile machine or, in the case where a fax adaptor is used, by loop disconnect or DTMF dialling information between the mobile facsimile terminal and the fax adaptor.

When the call is answered, the synchronization process will be started and the RLP will be established across the radio interface.

On completion of the synchronization process across the radio interface or RLP establishment, the modem at the IWF will be automatically selected and send CNG (mandatory) to PSTN facsimile terminal. Also CT107 shall be turned on by the TAF/UE.

In the case where a fax adaptor is used, the receipt of circuit 107 shall cause the fax adaptor to connect to line.

The analogue links at both the PSTN side and the mobile side (where a fax adaptor is used) will be established in accordance with the appropriate V. series recommendation.

Note that circuit 109 and circuit 106 at the R interface of the TAF/UE shall be turned on by the fax adaptor at the IWF before any further procedure may be carried out between the fax adaptors and consequently end-to-end. Once the connection is established, circuit 109 is clamped to the ON condition by the fax adaptor at the IWF, so fixing a full duplex mode throughout the whole facsimile phase of the call.

#### 9.2.2.3 Manual calling

Refer to diagram in figure II.5/GSM 23.146. When the call is answered, the RLP will be established across the radio interface providing circuit 108/2 in ON condition.

In the case where a fax adaptor is used, the mobile facsimile terminal shall be connected to line by manual intervention at this stage, and will cause the fax adaptor to turn on circuit 108/2 (according to ITU-T Recommendation V.24) towards the TAF/UE.

In the case where a UMTS facsimile machine is used, circuit 108/2 shall be turned on when the UMTS facsimile machine is connected to line by manual intervention.

After turning on circuit 108/2, a fax adaptor sends "ATD" to TAF according to 3G TS 27.007.

On completion of the synchronization process across the radio interface or RLP establishment, the modem at the IWF will be automatically selected and send CNG (mandatory) to PSTN facsimile terminal. Also circuit 107 shall be turned on by the TAF/UE.

In the case where a fax adaptor is used, the receipt of circuit 107 shall cause the fax adaptor to connect to line.

The analogue links at both the PSTN side and the mobile side (where a fax adaptor is used) will be established in accordance with the appropriate ITU-T V. series recommendation.

Note that circuit 109 and circuit 106 at the R interface of the TAF/UE shall be turned on by the fax adaptor at the IWF before any further procedure may be carried out between the fax adaptors and consequently end-to-end. Once the connection is established, both circuit 106 and circuit 109 are clamped to the ON condition by the fax adaptor at the IWF, so fixing a full duplex mode throughout the whole facsimile phase of the call.

# 10 Interworking to fixed networks

PSTN and ISDN only are considered, both used as transit networks to complement the PLMN in the end-to-end connection between facsimile group 3 terminal, figure 7/23.146.

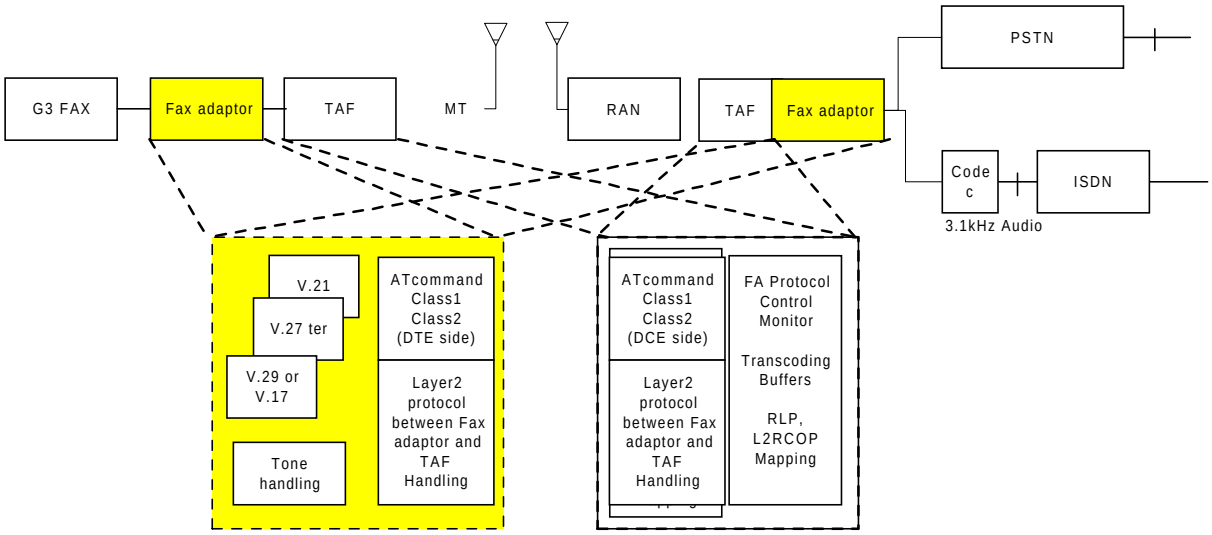


**Figure 7/23.146: Network interworking**

# 10.1 Interworking to PSTN

As the standard access of facsimile group 3 terminals for this Teleservice is a 2-wire analogue interface, all the technical requirements for network interworking to PSTN are identical in principle to those encountered for the terminal connection to the UE. The key functional block is the fax adaptor described in clause 6 of this specification.

As far as network interworking is concerned, the main function to be performed by such a block is the correct managing of a composite modem, in accordance with the requirements of ITU-T Recommendation T.30:

- ITU-T Recommendation V.21 synchronous mode, as standard facility for all BCS phases;
- ITU-T Recommendation V.27ter for message speeds of 4 800 and 2 400 bit/s;

- ITU-T Recommendation V.29 for message speeds of 9 600 and 7 200 bit/s.
- ITU-T Recommendation V.17 for message speeds of 14400,12000, 9600, 7200 bit/s.

The mechanism for selecting the right modem is the following:

- the actual message speed is obtained by detecting the DCS frame (see table 2/ITU-T Recommendation T.30) while in BCS phase;
- on entering the message phase, there is an interchange between the V.21 modem and the actual modem agreed upon between the terminals for message transmission;
- on exiting the message phase (RTC) the ITU-T Recommendation V.21 modem is selected again.

Times for settling the modem will be in accordance with the requirements of ITU-T Recommendation T.30.

## 10.2 Interworking to ISDN

The use of 3.1 kHz audio bearer capability of ISDN allows for an interworking of PLMN very similar in practice to the scheme for PSTN, figure 7/23.146. The fax adaptor function is in conformance with the description given in clause 4 and subclause 8.1 of this specification.

# Annex A (normative): Structure and contents of the fax adaptor protocol elements

The things except for the defined things in TS 23.146 conform to T.38.

## 1 IFP

- T30_INDICATOR

Only the following packets are only used.

1. CNG
2. CED
3. DCN transmission confirmation (not in T.38)
4. TCF error detection (not in T.38)

- T30_DATA

1. V.21 channel 2 (except MCF, CFR, RTN, RTP, PIP, PIN, PRI, PPR, NSF, NSC, RR, RNR, ERR)
2. V.27 ter 2400
3. V.27 ter 4800
4. V.29 7200
5. V.29 9600
6. V.17 7200
7. V.17 9600
8. V.17 12000
9. V.17 14400

In T30_ DATA, maximum length of T.4-Non-ECM/HDLC data is equal to 1400[Octs].

Aligned Packet Encoding Rule[21] is applied to ANS.1.

## 2 UDPTL

No FEC option and No redundant message option

## 3 UDP

Prot number at client side is ephemeral and port number at server side is manually preassigned by operater.

# 4 IP

IP address is not actually needed because addressing is based on the way of CS in UMTS. However, IP address is normally treated for co-ordination with real IP.

IP address at UE side and IWF side are assigned by PPP.

# 5 PPP

RFC 1662, 1661, 1570 and 1332 are applied.

# 6 Typical frame mapping within FA protocol and that between FA protocol and RLP/L2RCOP

Refer also to 3G TS 27.002

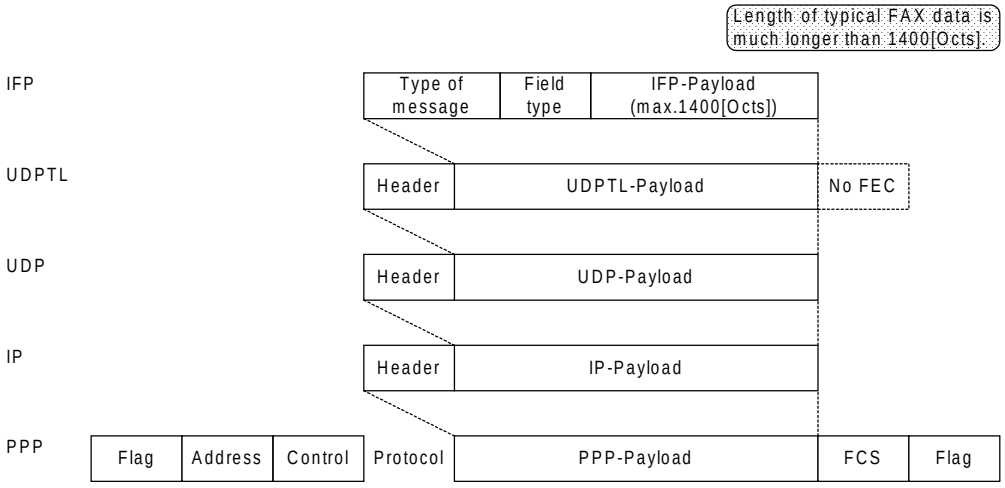


**Figure A.1/23.146: Typical frame mapping within " FA protocol**

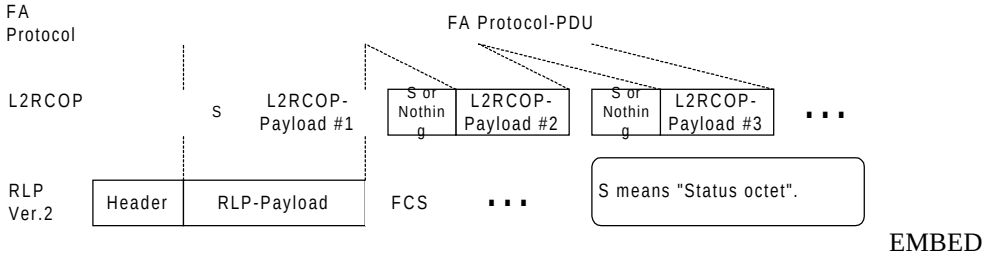


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**Figure A.2/23.146: Typical frame mapping between FA Protocol and RLP**

# Appendix I (informative): Abbreviations from ITU-T Recommendation T.30 and T.4

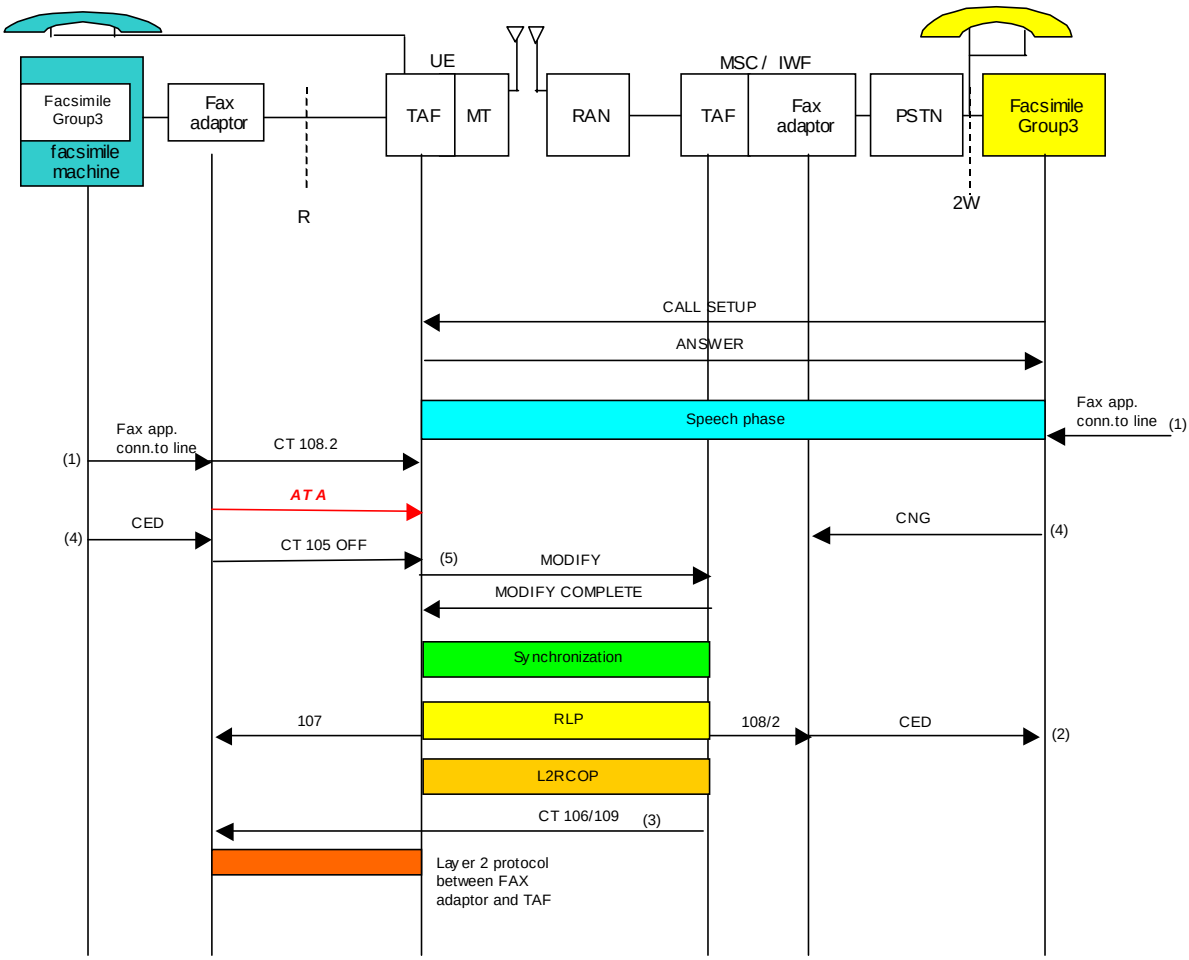
**Table I.1/23.146: Abbreviations from ITU-T Recommendation T.30**

| Abbre-viation | Function | Signal format | T.30 standard | T.30 err.corr. |
|---|---|---|---|---|
| CED | Called station identification | 2100 Hz | X | X |
| CFR | Confirmation to receive | X010 0001 | X | X |
| CRP | Command repeat | X101 1000 | X | X |
| CIG | Calling subscriber identification | 1000 1000 | X | X |
| CNG | Calling tone | 1100 Hz | X | X |
| CSI | Called subscriber identification | 0000 0010 | X | X |
| CTC | Continue to correct | X100 1000 | | X |
| CTR | Response to continue to correct | X010 0011 | | X |
| DCN | Disconnect | X101 1111 | X | X |
| DCS | Digital command signal | X100 0001 | X | X |
| DIS | Digital identification signal | 0000 0001 | X | X |
| DTC | Digital transmit command | 1000 0001 | X | X |
| EOM | End of message | X111 0001 | X | |
| EOP | End of procedure | X111 0100 | X | |
| EOR | End of retransmission | X111 0011 | | X |
| ERR | Response to end of retransmission | X011 1000 | | X |
| FCD | Facsimile coded data | 0110 0000 | | X |
| FCF | Facsimile control field | --- | X | X |
| FCS | Frame checking sequence | 16 bits | X | X |
| FIF | Facsimile information field | --- | X | X |
| FTT | Failure to train | X010 0010 | X | X |
| MCF | Message confirmation | X011 0001 | X | X |
| MPS | Multi-page signal | X111 0010 | X | |
| NSC | Non-standard facilities command | 1000 0100 | X | X |
| NSF | Non-standard facilities | 0000 0100 | X | X |
| NSS | Non-standard set-up | X100 0100 | X | X |
| PIN | Procedural interrupt negative | X011 0100 | X | X |
| PIP | Procedural interrupt positive | X011 0101 | X | X |
| PIS | Procedure interrupt signal | 462 Hz | X | X |
| PPR | Partial page request | X011 1101 | | X |
| PPS | Partial page signal | X111 1101 | | X |
| PRI | Procedure interrupt | X111 XXXX | X | |
| RCP | Return to control for partial page | 0110 0001 | | X |
| RNR | Receive not ready | X011 0111 | | X |
| RR | Receive ready | X111 0110 | | X |
| RTN | Retrain negative | X011 0010 | X | X |
| RTP | Retrain positive | X011 0011 | X | X |
| TCF | Training check frame | 0... 1.5s | X | X |
| TSI | Transmitting subscriber identification | X100 0010 | X | X |

**Table I.2/23.146: Abbreviations from ITU-T Recommendation T.4**

| Abbre-viation | Function | Signal format |
|---|---|---|
| EOL | End of line | 0000 0000 0001 |
| RTC | Return to control | 6 * EOL |

# Appendix II (informative):Procedure examples

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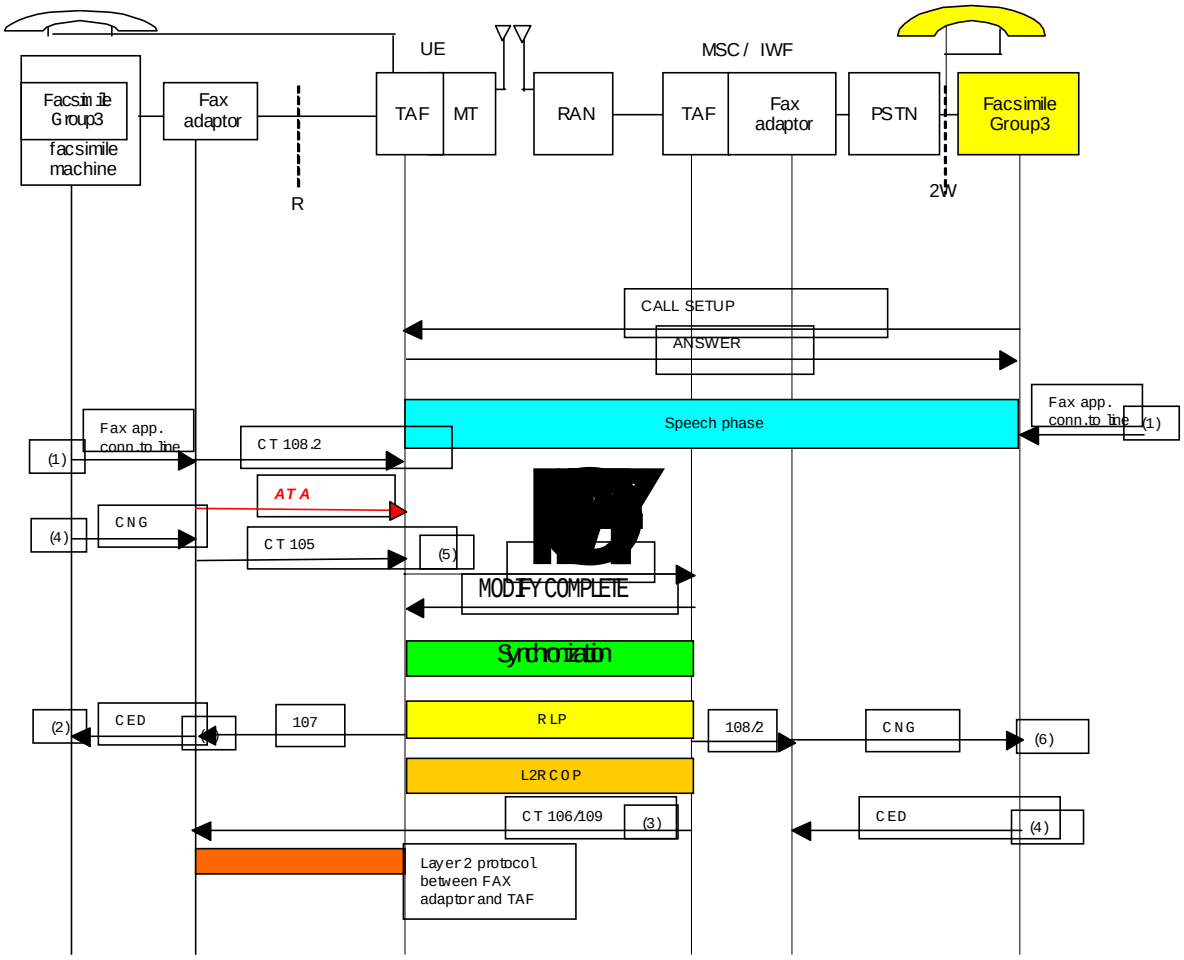
106, 107, 108/2, 109: circuits according to CCITT Recommendation V.24
(1) manual intervention
(2) mandatory
(3) locally generated by the fax adaptor at IWF
(4) optionally
(5) triggered by delayed CT108.2 (3 sec)

**Figure II.1a/23.146: Mobile terminated call - speech then facsimile DCD mobile terminated**

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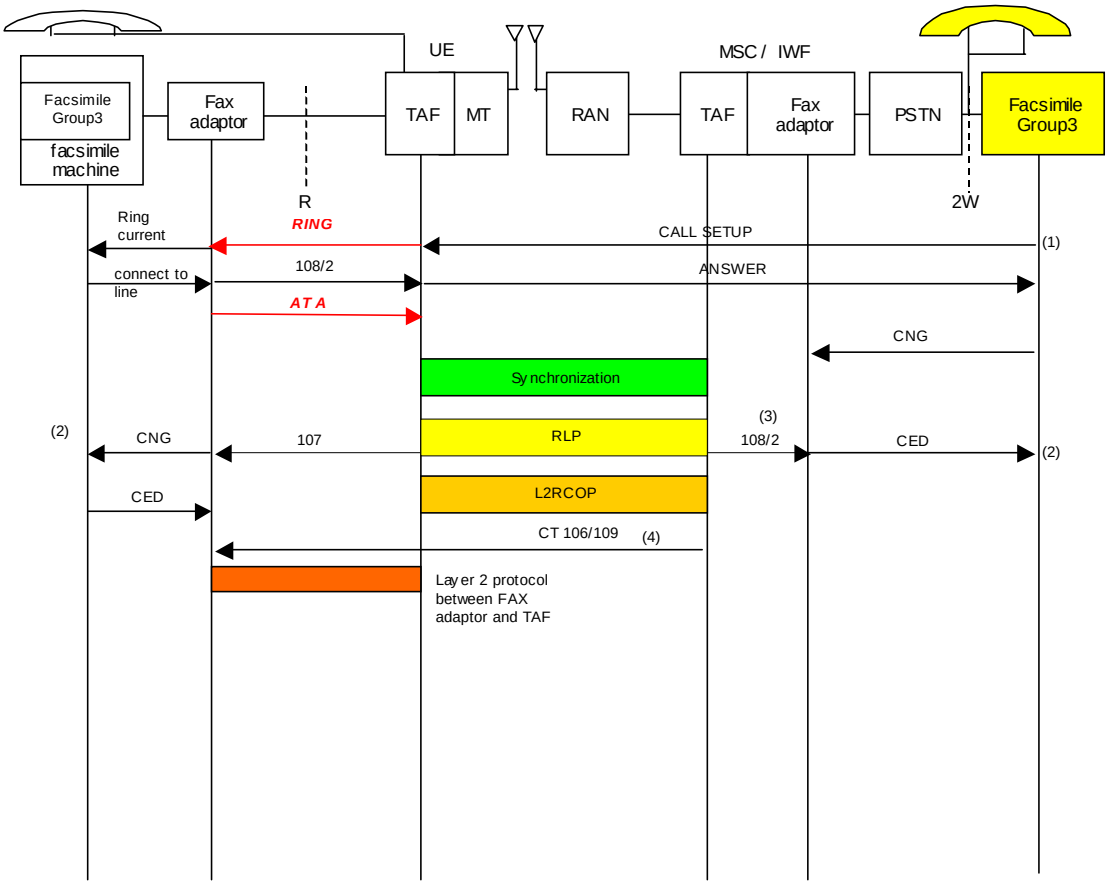
106, 107, 108/2, 109: circuits according to CCITT Recommendation V.24
(1) manual intervention
(2) mandatory
(3) locally generated by fax adaptor at IWF
(4) optionally
(5) triggered by delayed CT108.2 (3 sec)
(6) transmitted only if neither CED nor BCS is already received

**Figure II.1b/23.146: Mobile terminated call - speech then facsimile DCD mobile originated**

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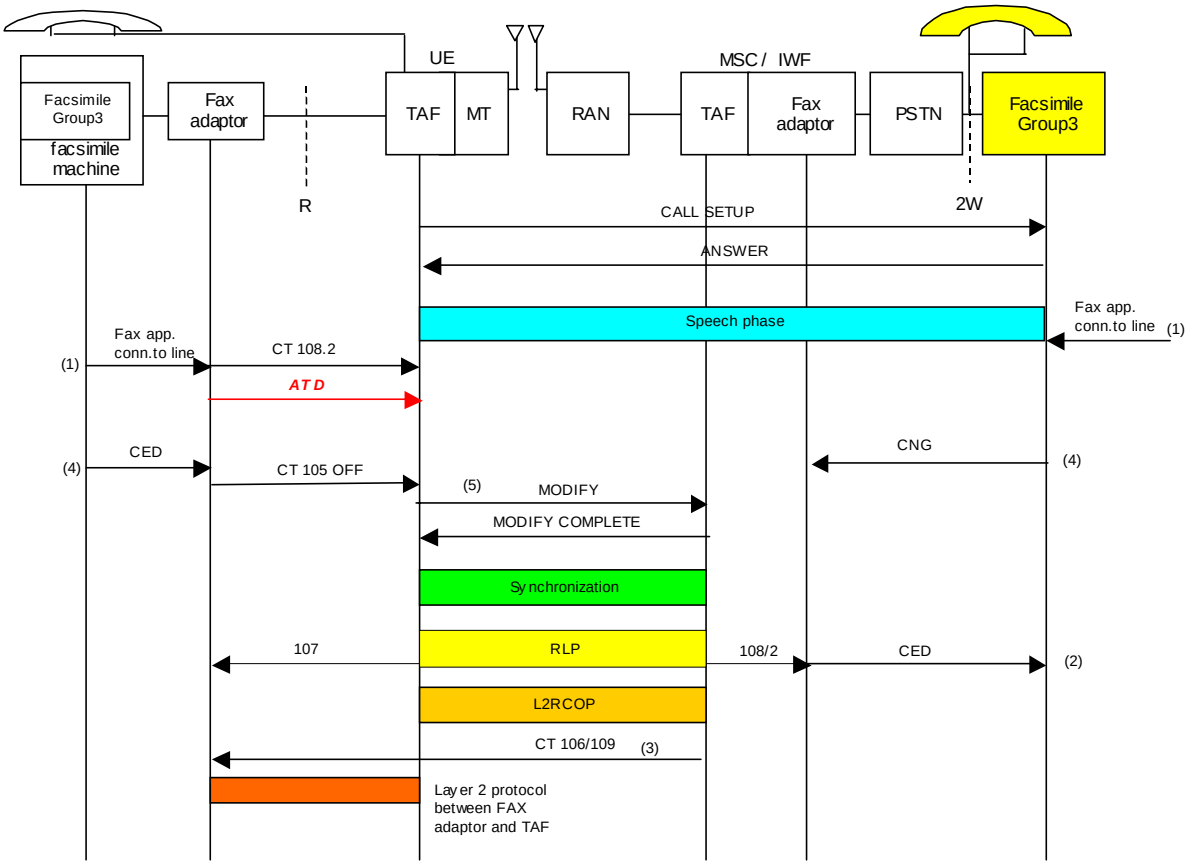
**BED**

106, 107, 108/2, 109, 125: circuits according to CCITT Recommendation V.24
(1) manual or automatic operation
(2) mandatory
(3) either after synchronization or RLP establishment
(4) locally generated by fax adaptor at IWF

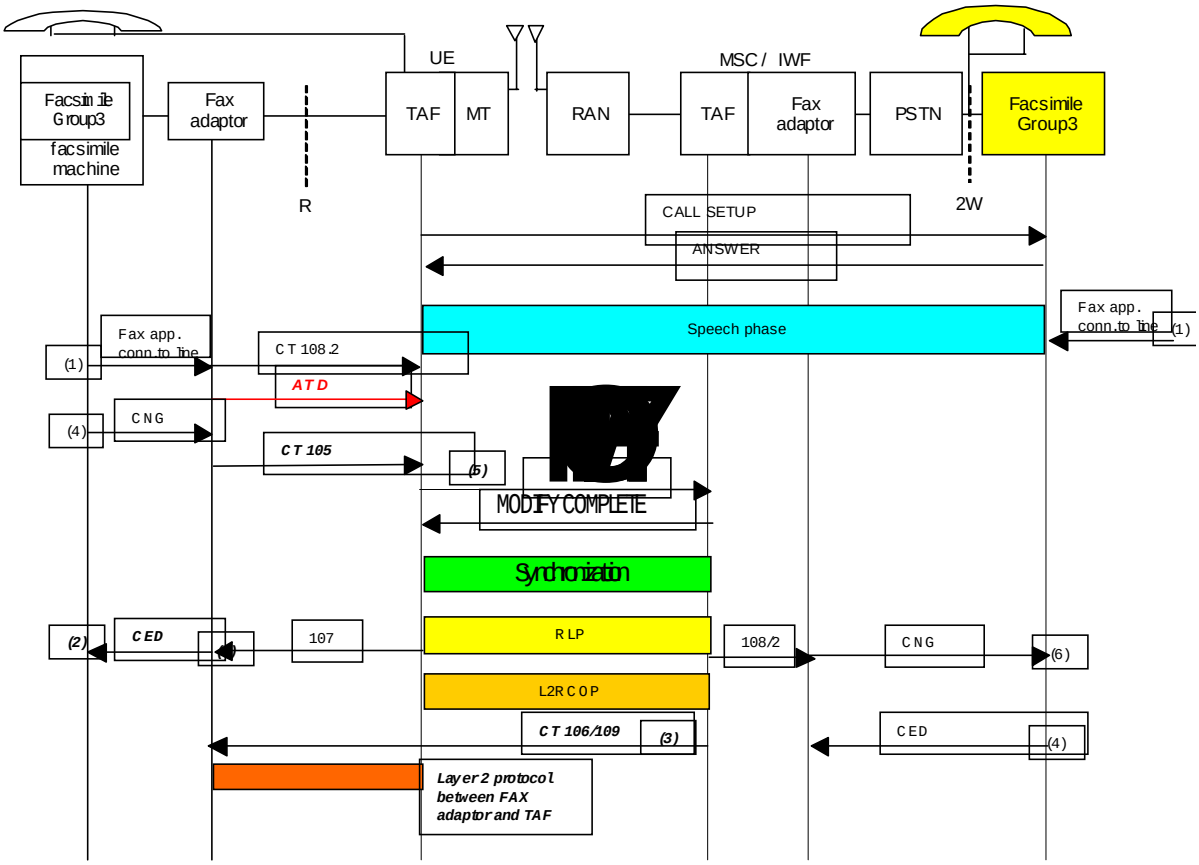
**Figure II.2/23.146: Mobile terminated call - auto answer**




**EMBED**

106, 107, 108/2, 109: circuits according to CCITT Recommendation V.24
(1) manual intervention
(2) mandatory
(3) locally generated by fax adaptor at IWF
(4) optionally (5) triggered by delayed CT108.2 (3 sec)

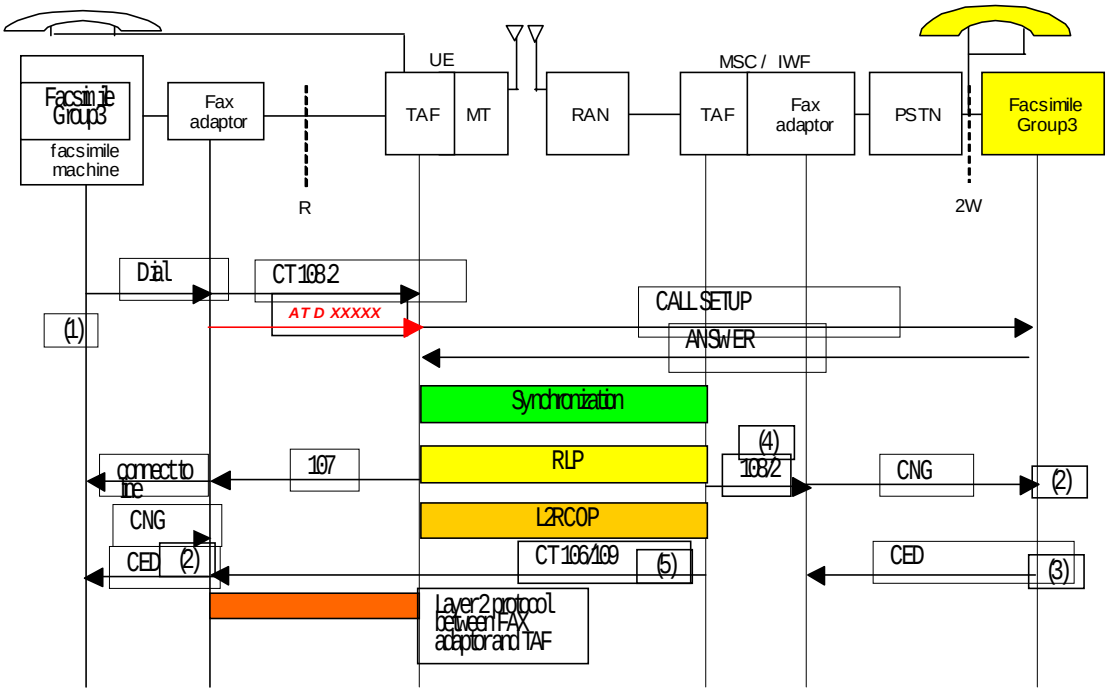
**Figure II.3a/23.146: Mobile originated call - speech then facsimile DCD mobile terminated**




**EMBED**

106, 107, 108/2, 109: circuits according to CCITT Recommendation V.24
(1) manual intervention
(2) mandatory
(3) locally generated by fax adaptor at IWF
(4) optionally (5) triggered by delayed CT108.2 (3 sec)
(6) transmitted only if neither CED nor BCS is already received

**Figure II.3b/23.146: Mobile originated call - speech then facsimile DCD mobile originated**



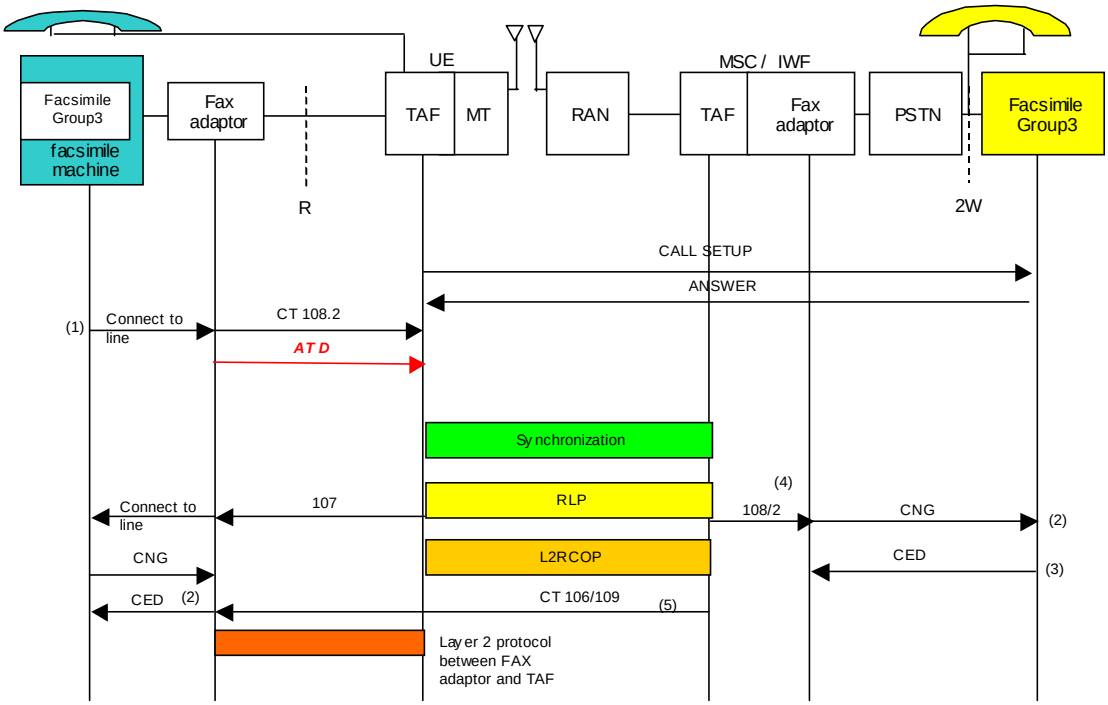

**EM**

**BED**

106, 107, 108/2, 109: circuits according to CCITT Recommendation V.24

(1) manual intervention
(2) mandatory
(3) PSTN fax terminal may be manually or automatically answered
(4) either after synchronization or RLP establishment
(5) locally generated by fax adaptor at IWF

**Figure II.4/23.146: Mobile originated call - auto calling**

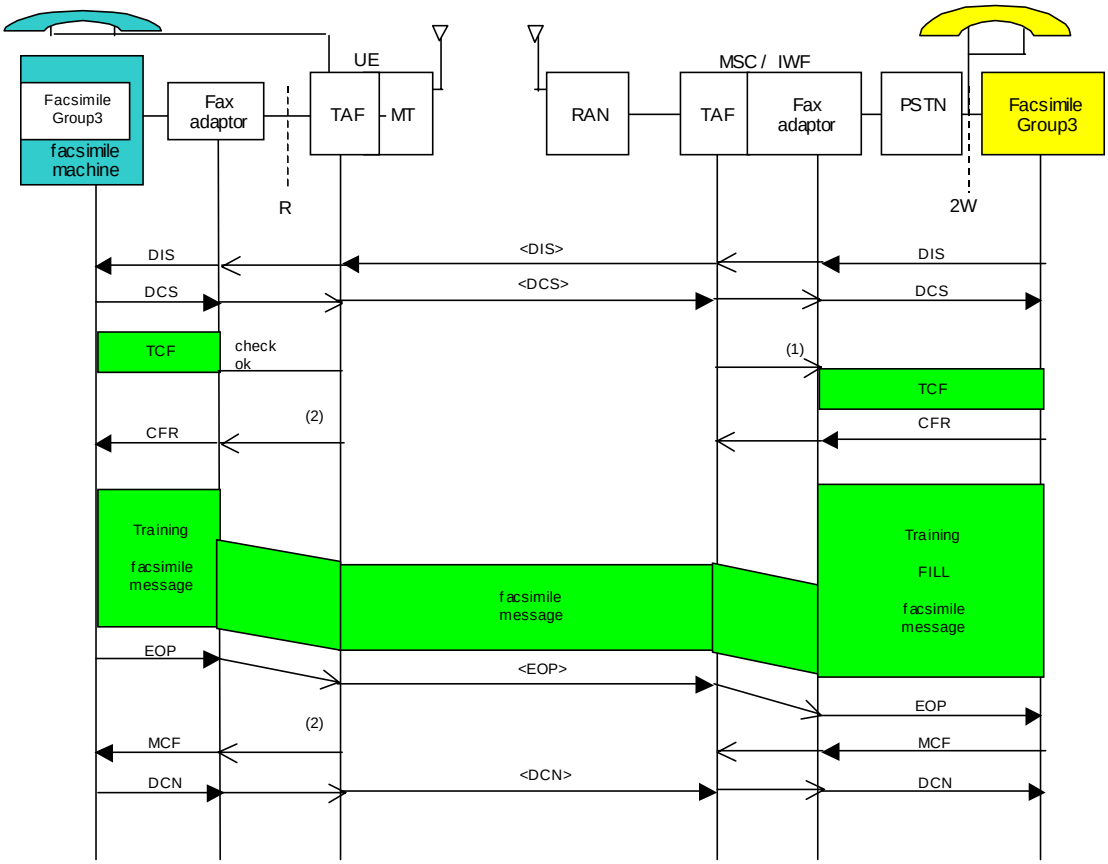



**EM**

**BED**

106, 107, 108/2, 109: circuits according to CCITT Recommendation V.24
(1) manual intervention
(2) mandatory
(3) PSTN fax terminal may be manually or automatically answered
(4) either after synchronization or RLP establishment
(5) locally generated by fax adaptor at IWF

**Figure II.5/23.146: Mobile originated call - manual calling**



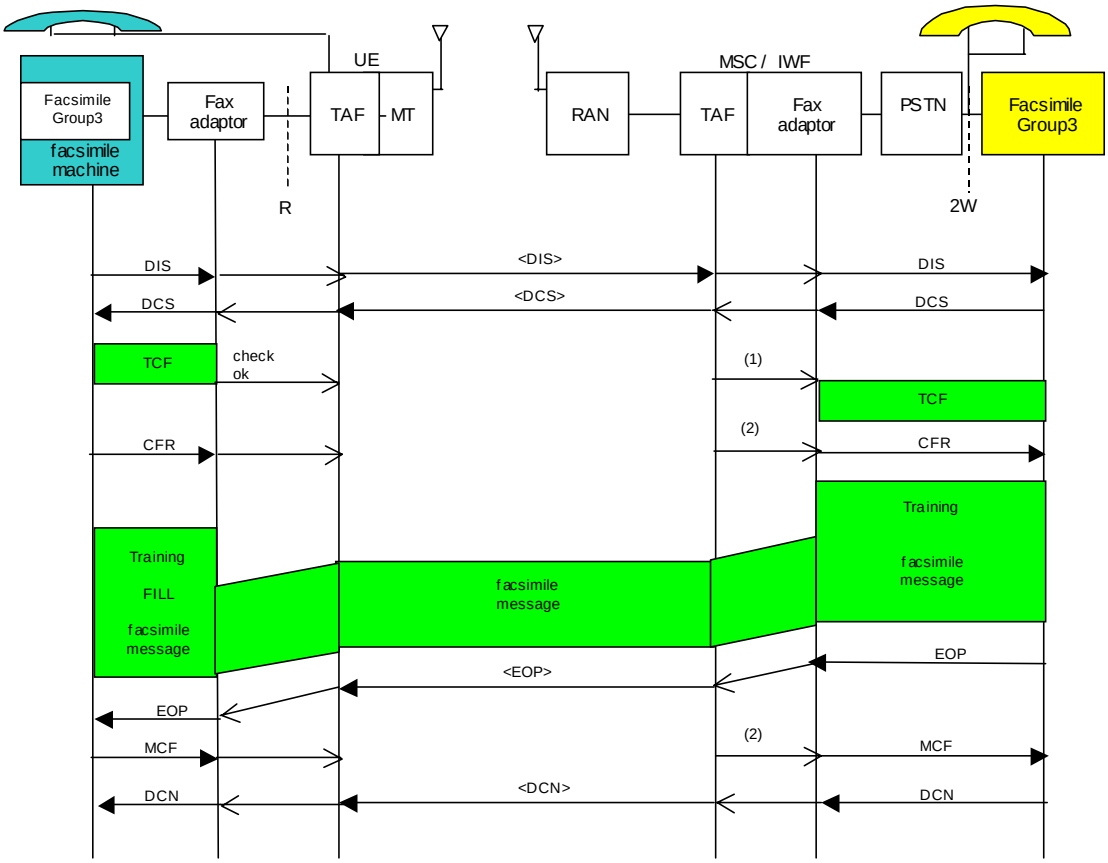

**EM**

**BED**

**(1) triggered by delayed DCS(75 ms)**

**(2) triggered by busy off(flow control)**

**Figure II.6/23.146: Mobile originated facsimile transmission**



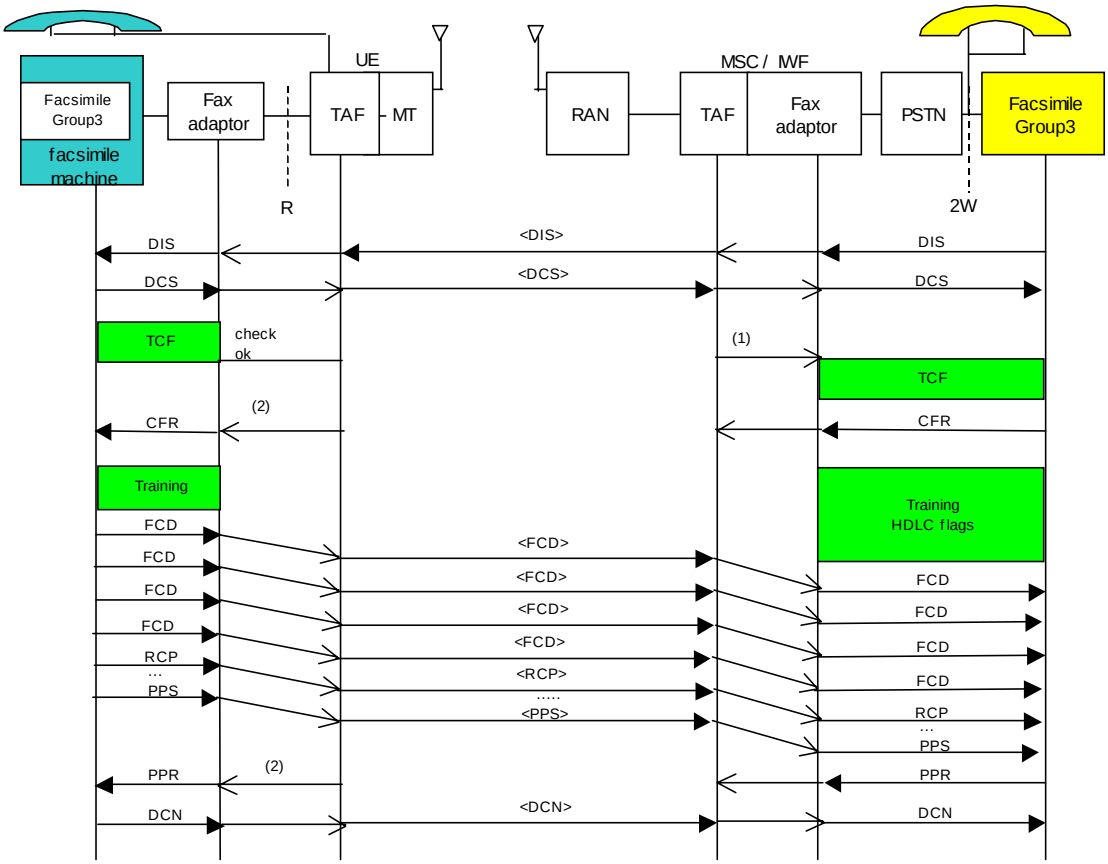

**EM**

**BED**

**(1) triggered by delayed DCS(75 ms)**

**(2) triggered by busy off (flow control)**

**Figure II.7/23.146: Mobile terminated facsimile transmission**



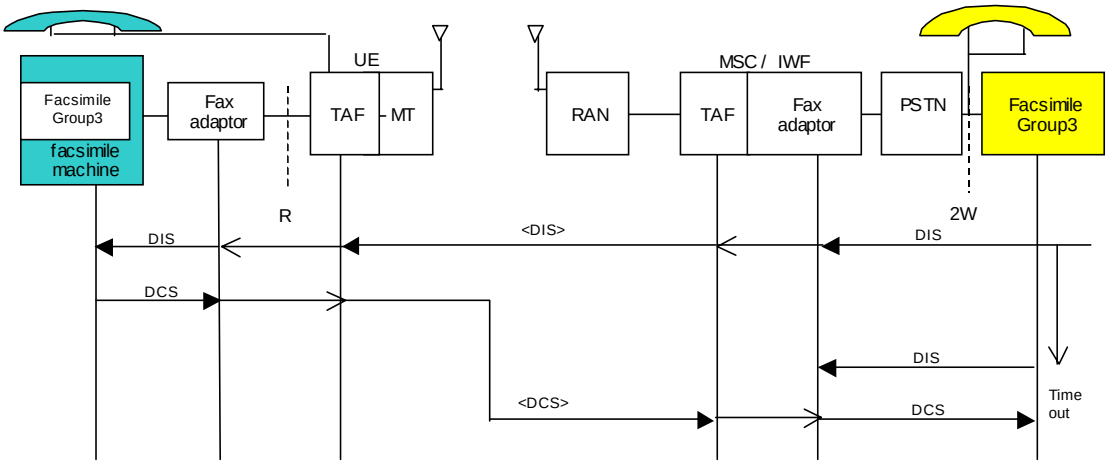

**EM**

**BED**

**(1) triggered by delayed DCS(75 ms)**

**(2) triggered by busy off (flow control)**

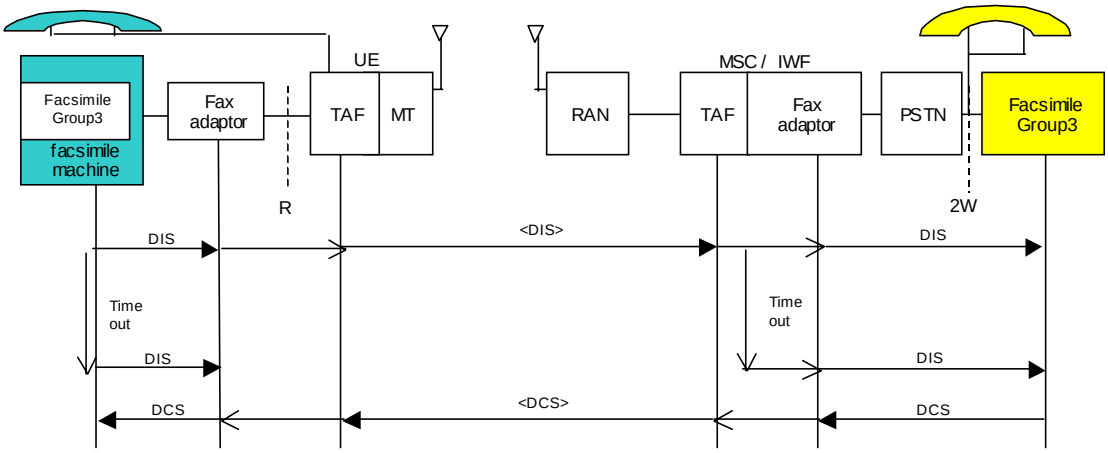
**Figure II.8/23.146: Mobile originated facsimile transmission (error correction mode)**




**EM**

**BED**

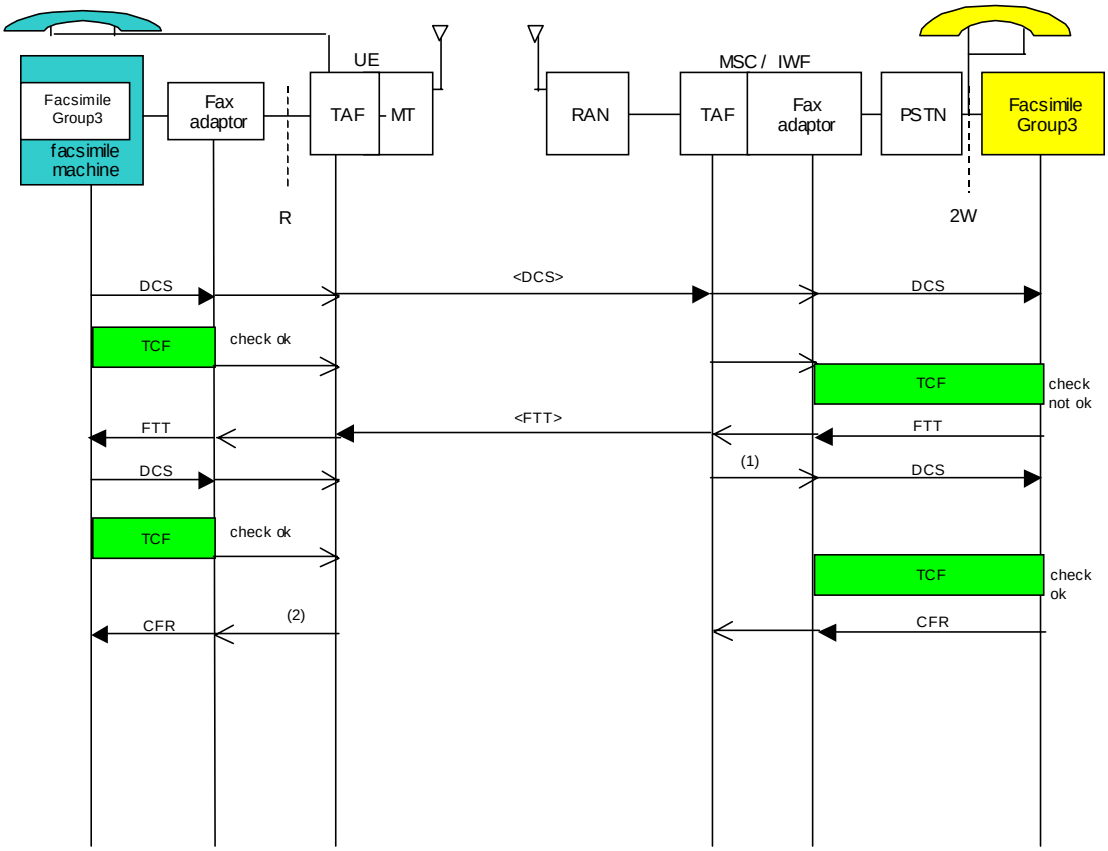
**Figure II.9/03.46: Mobile originated facsimile transmission - error recovery (example)**




**EM**

**BED**

**Figure II.10/23.146: Mobile terminated facsimile transmission - error recovery (example)**



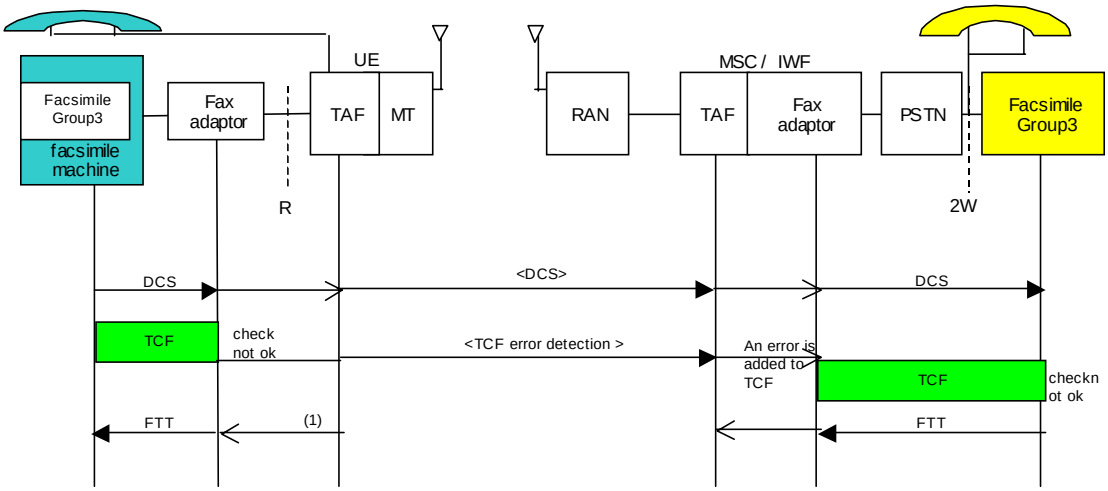

**EM**

**BED**

**(1) triggered by delayed FTT(75 ms)**

**(2) triggered by busy off (flow control)**

**Figure II.11/23.146: Mobile originated facsimile transmission - error recovery (example)**

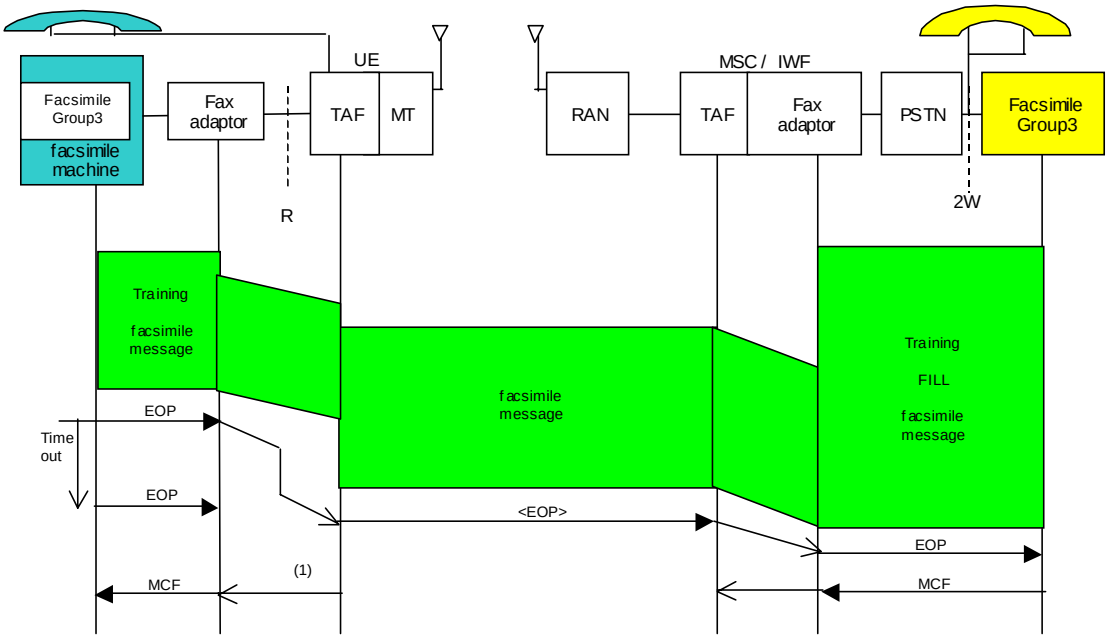



**EM**

**BED**

**(1) triggered by delayed TCF error detection element (2.4s)**

**Figure II.12/23.146: Mobile originated facsimile transmission - error recovery (example)**




**EM**

**BED**

**(1) triggered by busy off (flow control)**

**Figure II.13/23.146: Mobile originated facsimile transmission - error recovery (example)**

# Appendix III (informative): SDL Diagrams

| State symbol | Phase / Mode | | |
|---|---|---|---|
| A | Phase A | Transmission / Reception side TAF | NONECM / ECM |
| R-A1 | | Reception side TAF | |
| T | Phase B | Transmission side TAF | |
| T_B1 | | | |
| T_B2 | | | |
| T_B4 | | | |
| T_B5 | | | |
| R | | Reception side TAF | |
| R_B1 | | | |
| R_B3 | | | |
| R_B4 | | | |
| R_B5 | | | |
| T_C1 | Phase C | Transmission side TAF | NONECM |
| T_C2 | | | ECM |
| R_C1 | | Reception side TAF | NONECM |
| R_C2 | | | ECM |
| T_D1 | Phase D | Transmission side TAF | NONECM |
| T_D2 | | | ECM |
| T_D2_res1 | | | |
| T_D2_res2 | | | |
| R_D1 | | Reception side TAF | NONECM |
| R_D2 | | | ECM |
| R_D1_MPS | | | NONECM |
| R_D1_EOM | | | |
| R_D1_EOP | | | |
| R_D2_NULL | | | ECM |
| R_D2_MPS | | | |
| R_D2_EOM | | | |
| R_D2_EOP | | | |

| | | | |
|---|---|---|---|
| R_D2_E_NULL | | | |
| R_D2_E_MPS | | | |
| R_D2_E_EOM | | | |
| R_D2_E_EOP | | | |
| E1 | Phase E | Transmission / Reception side TAF | NONECM / ECM |
| E2 | | | |
| E3 | | | |

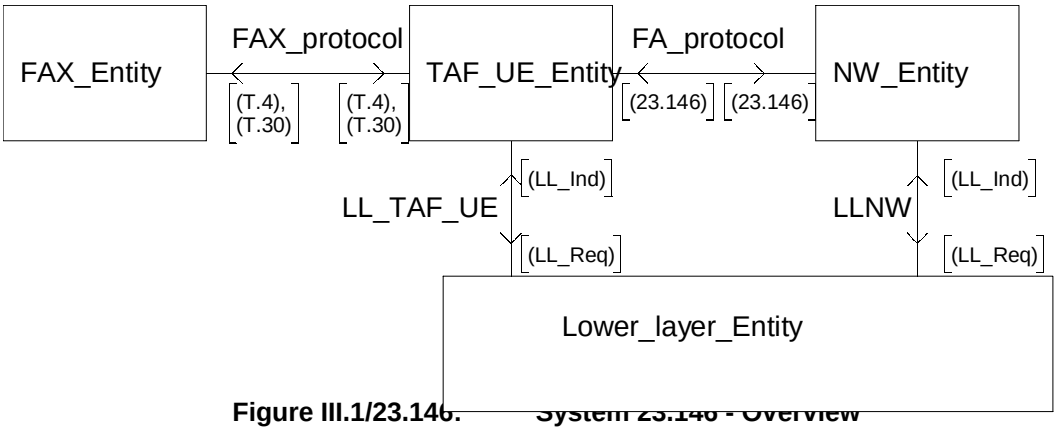
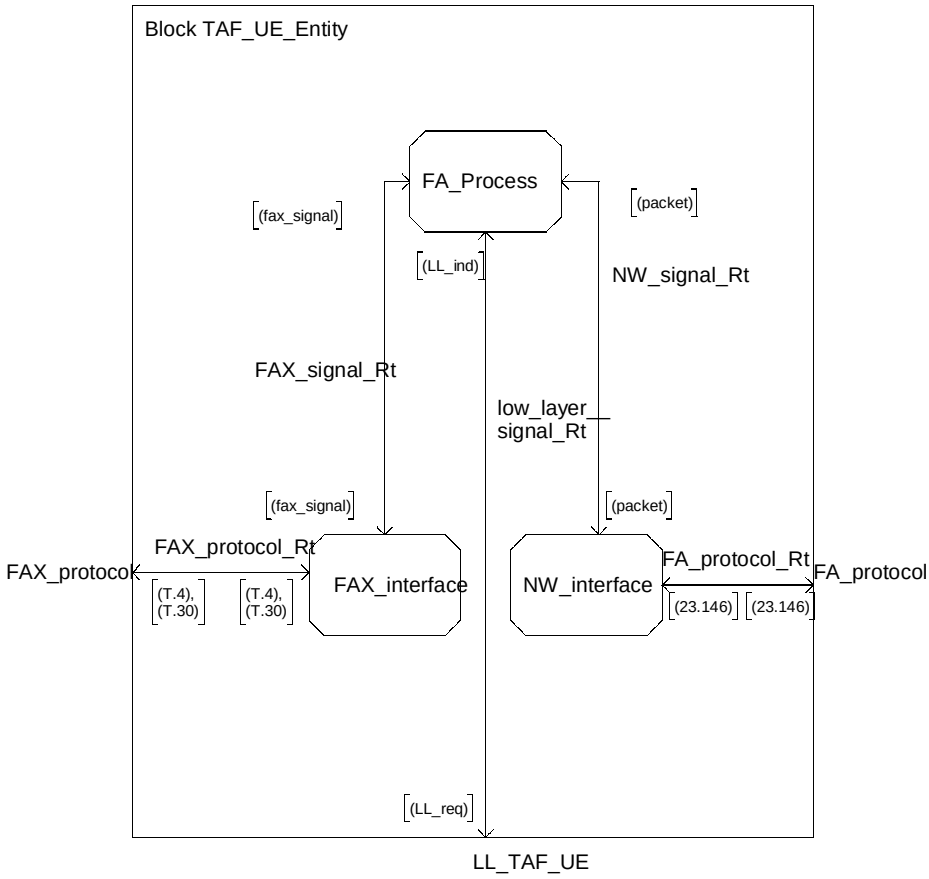



**Figure III.1/23.146: System 23.146 - Overview**




signallist fax_signal =

CED,
CFR,
CIG.DTC,
CNG,
CSI.DIS,
CSI.DIS.NSF,
CTC,
CTR,
EOM,
EOP,
EOR_EOM,
EOR_EOP,
EOR_MPS,
EOR_NULL,
ERR,
FTT,
MCF,
MPS,
PIX,
PIX.RCP,
PIX.RTC,
PPR,
PPS_EOM,
PPS_EOP,
PPS_MPS,
PPS_NULL,
preamble,
RNR,
RTN,
RTP,
TCF,
TCF_with_error;

signallist packet =

CED_packet,
CIG.DTC_packet,
CNG_packet,
CSI.DIS_packet,
CTC_packet,
DCN_packet,
DCN_transmit_congfirmation_packet,
DIS_packet,
DTC_packet,
EOL_packet,
EOM_packet,
EOP_packet,
EOR_Q_packet,
FCD_packet,
FTT_packet,
MPS_packet,
PPS_EOM_packet,
PPS_EOP_packet,
PPS_MPS_packet,
PPS_NULL_packet,
PPS_Q_packet,
TCF_error_detection_packet,
TSI.DCS_packet;

signallist LL_ind =

low_layer_established;

signallist LL_req =

low_layer_Disconnect;

**Figure III.2/23.146: Block TAF UE Entity**

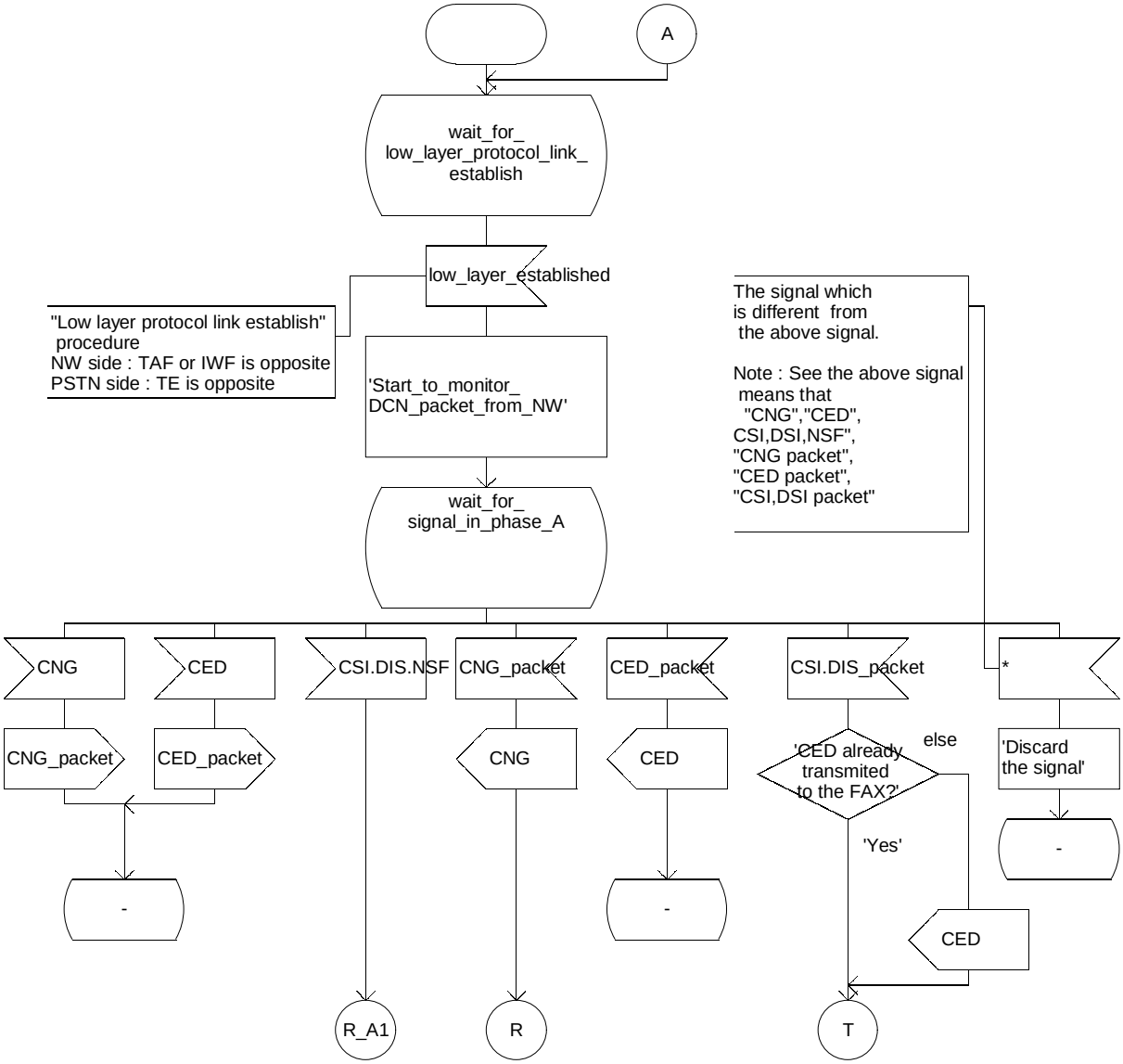



**Figure III.3/23.146: Initial operation flow for a facsimile TAF (Analogue)**

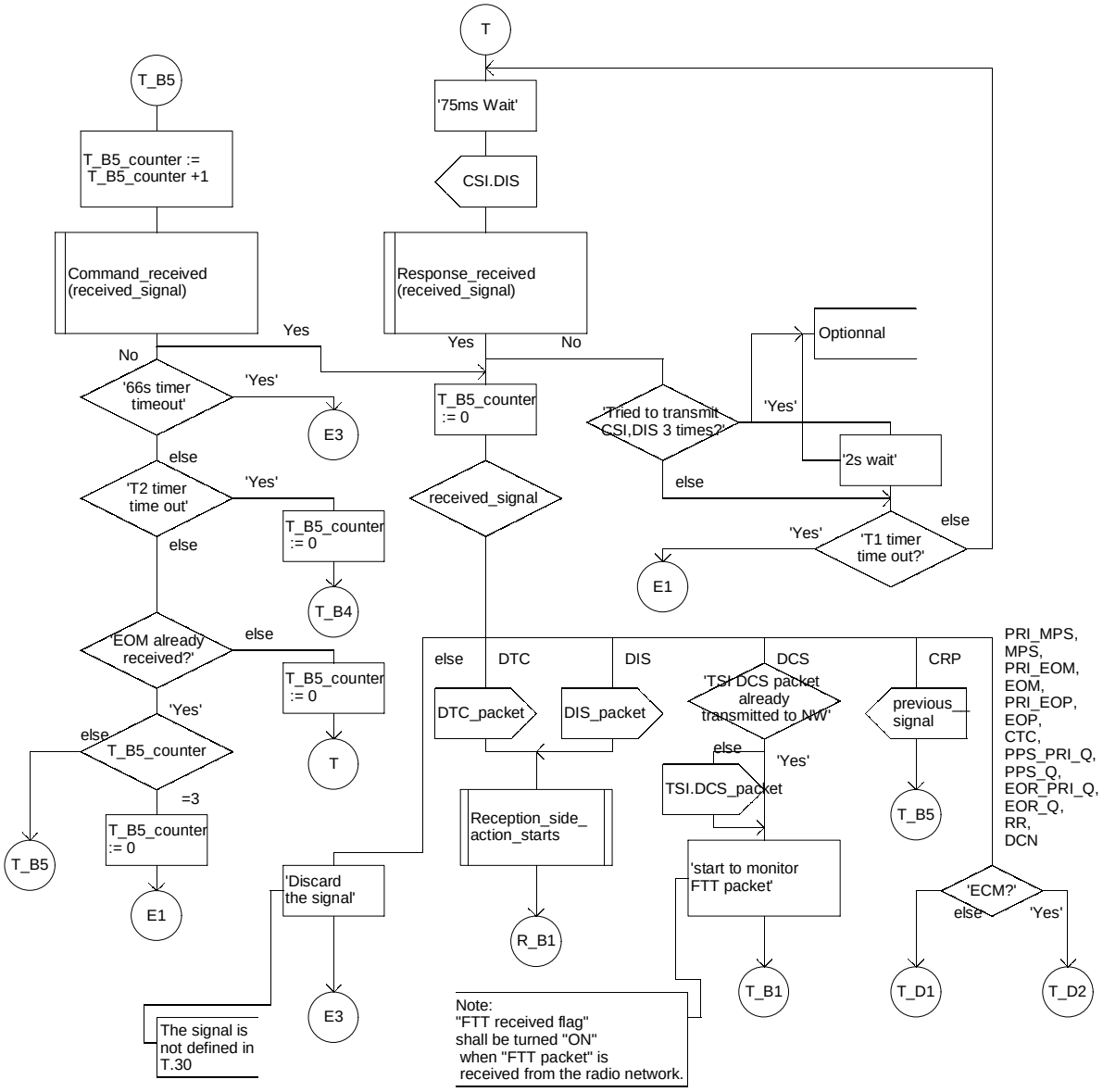



**Figure III.4/23.146: Transmission side TAF, Phase B (Basic control flow)**

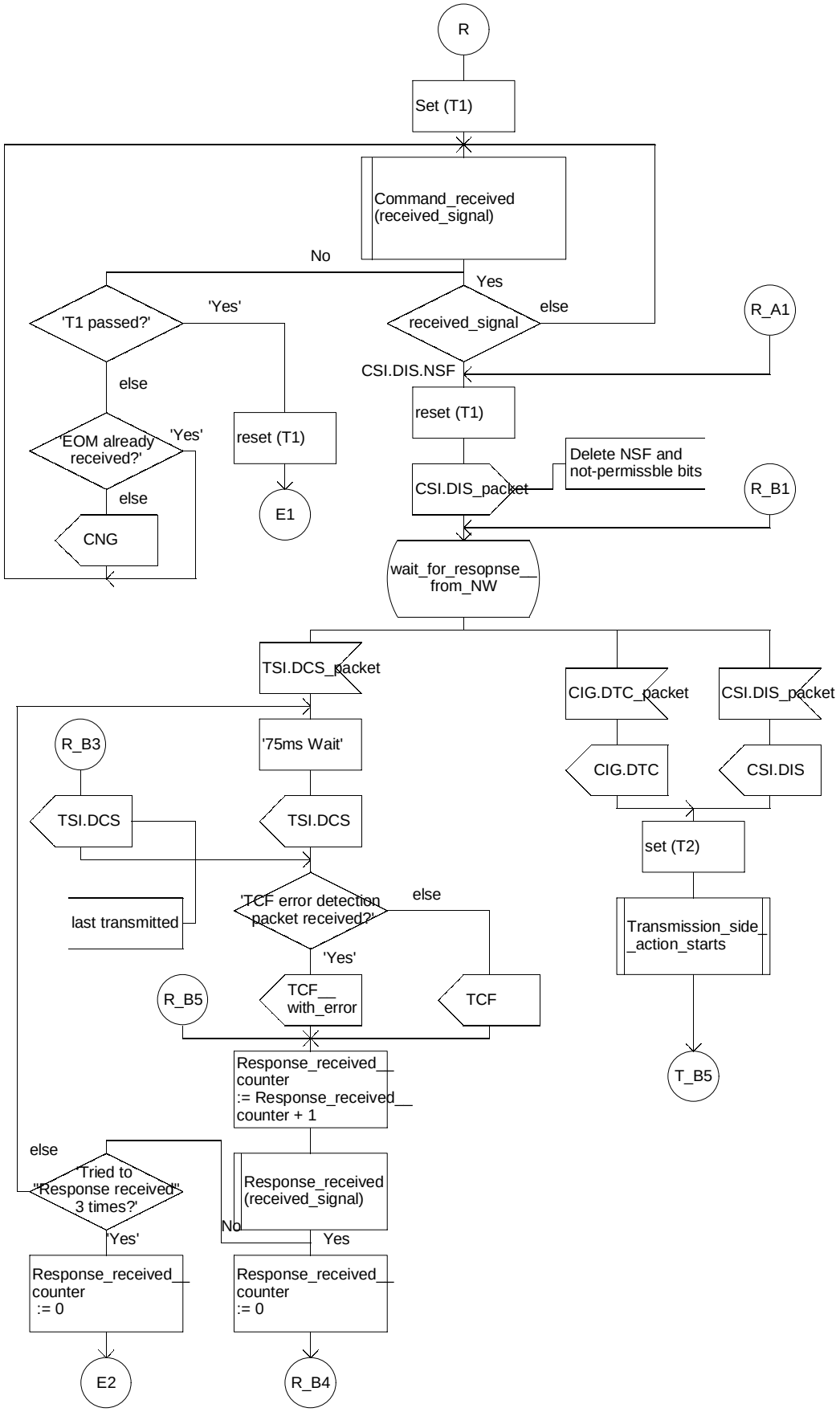



**Figure III.5/23.146: Reception side TAF, Phase B**

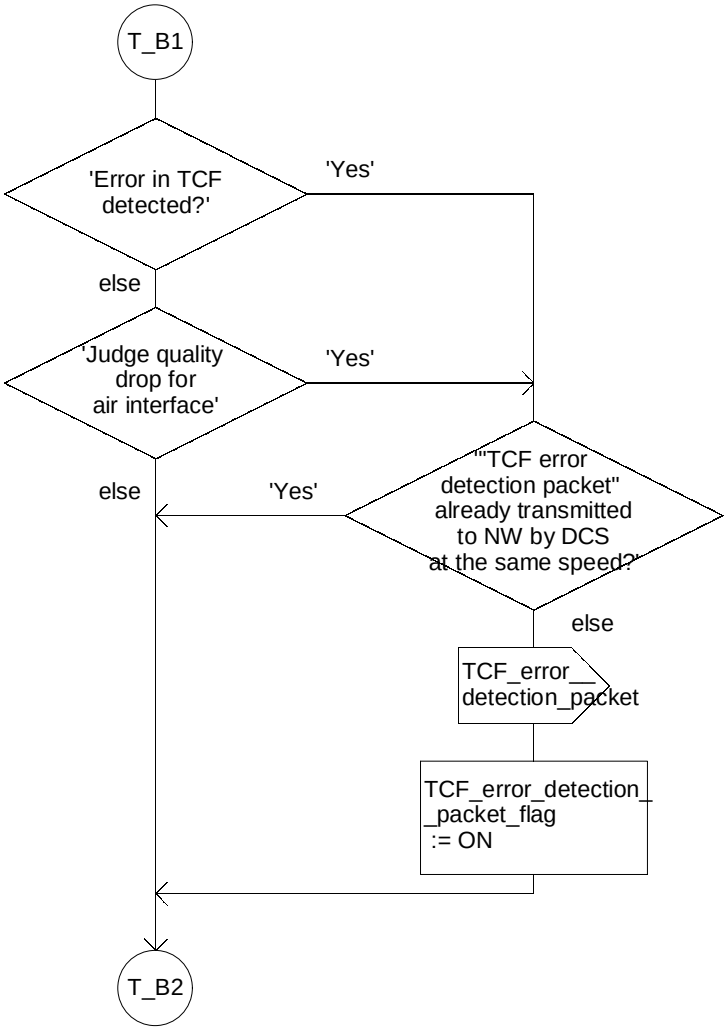



**Figure III.6/23.146: Output conditions for “TCF error detection” for ECM&NONECM**

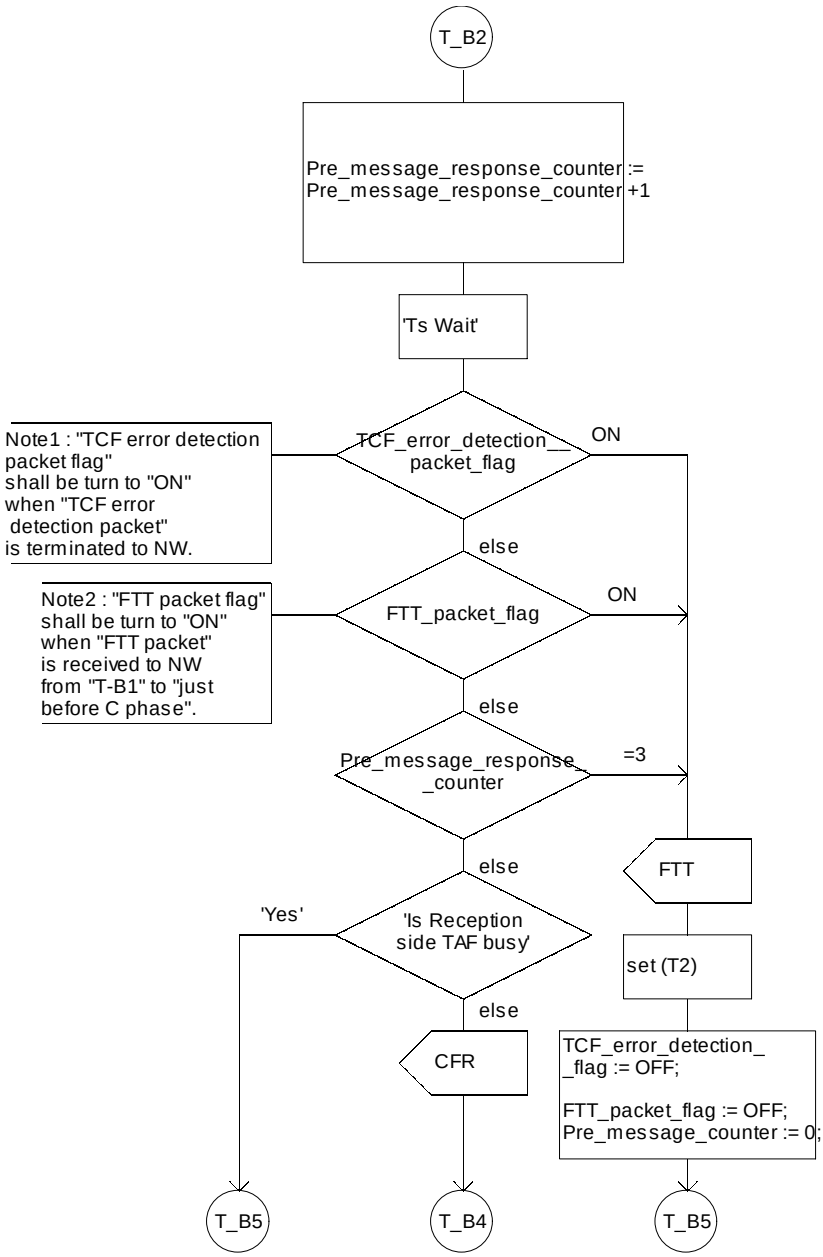



**Figure III.7/23.146: Selection algorithm for CFR /FTT for T-TAF ECM & NONECM**

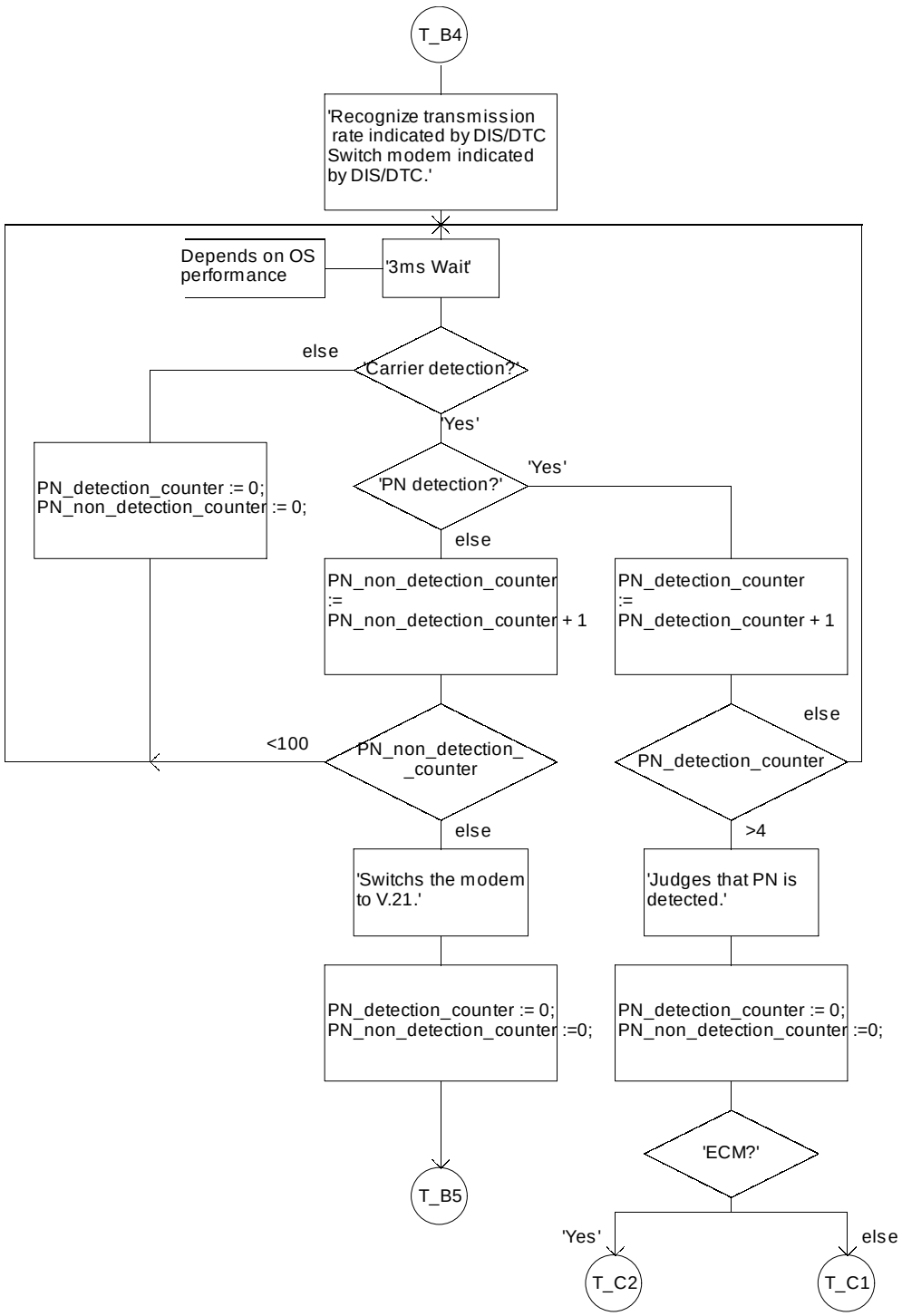



**Figure III.8/23.146: Stand-by method for V.21/V.17/V.27ter/V.29 for T-TAF**

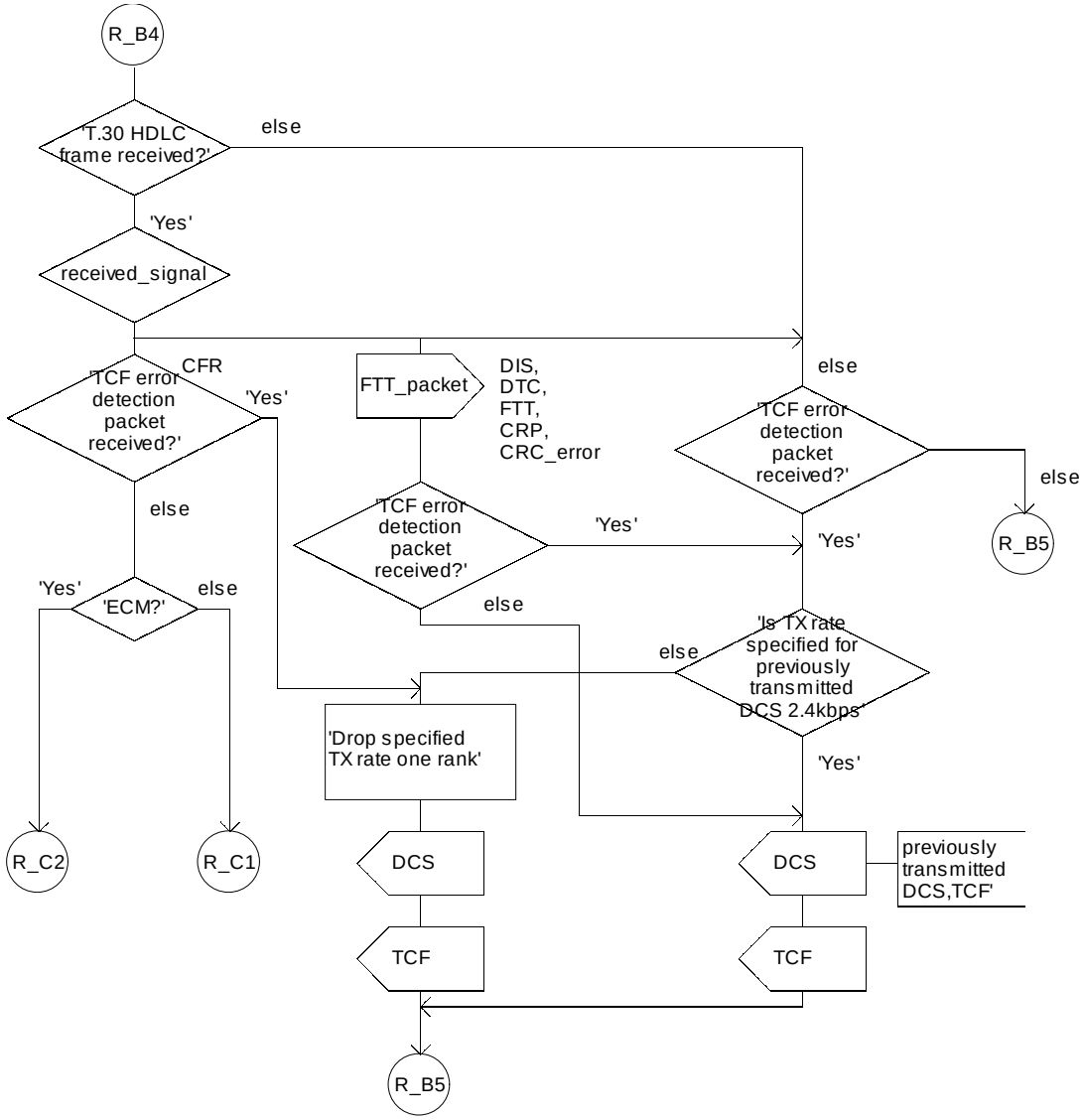



**Figure III.9/23.146: Output conditions for FTT and specified TX rate decision algorithm for DCS NONECM & ECM**

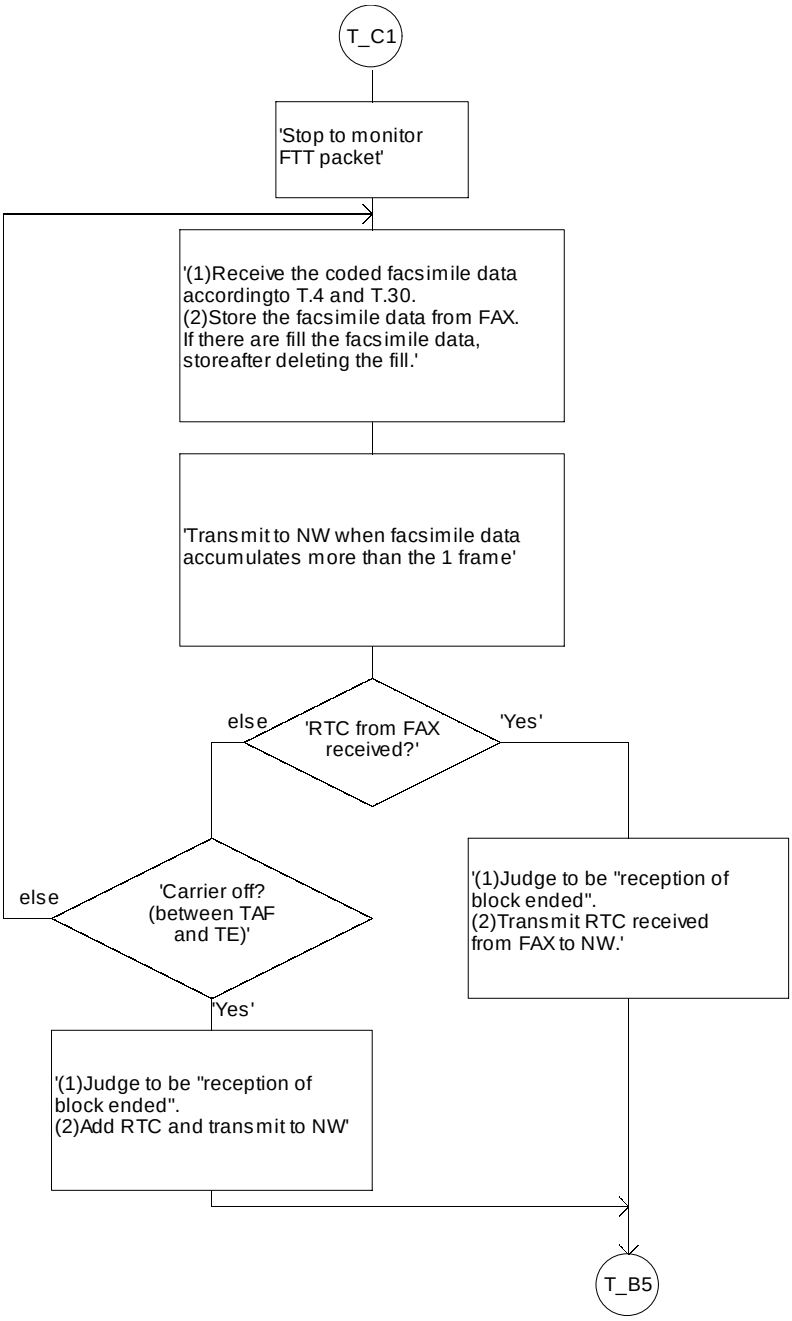



**Figure III.10/23.146: Transmission side TAF, Phase C for NONECM**

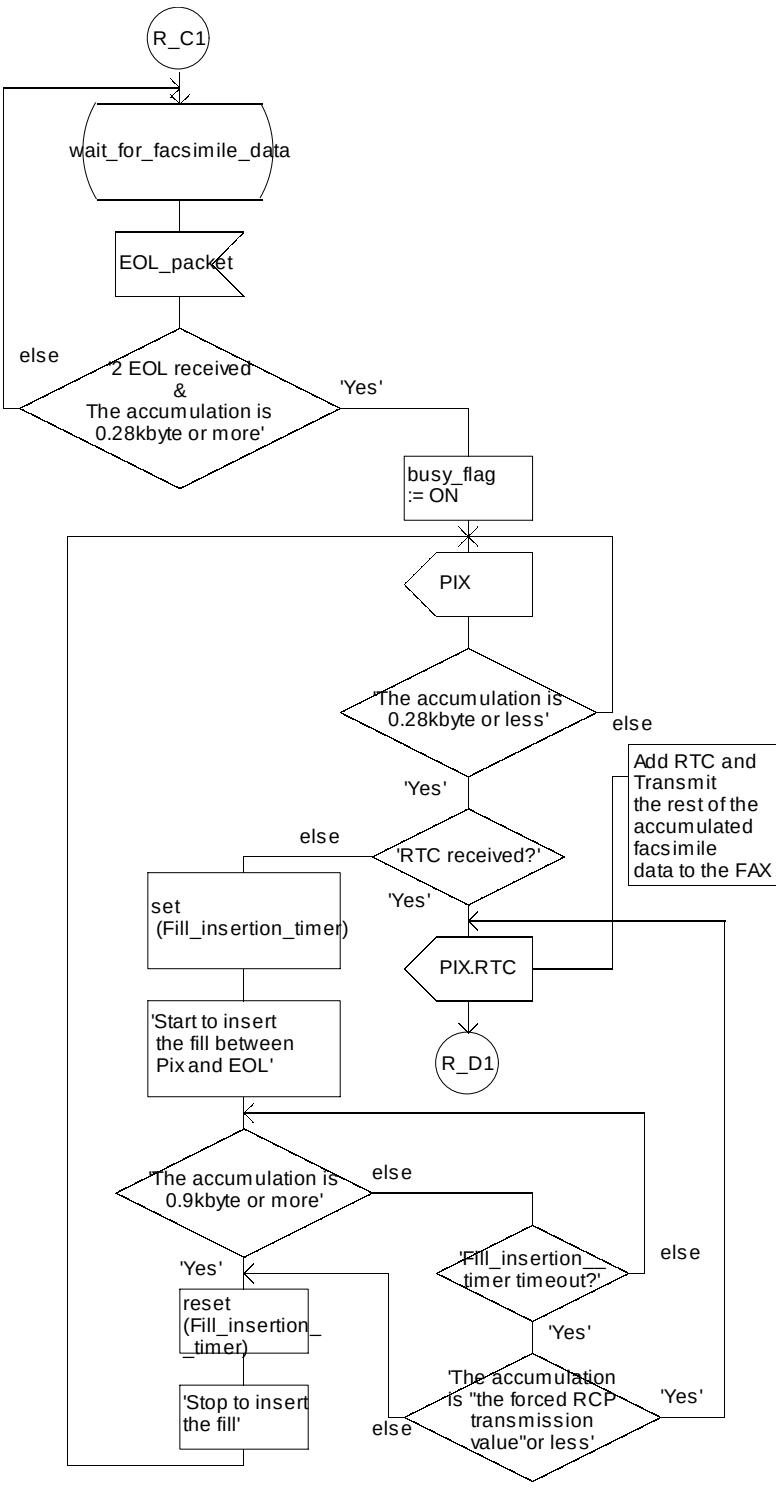



**Figure III.11/23.146: Reception side TAF, phase C for NONECM**

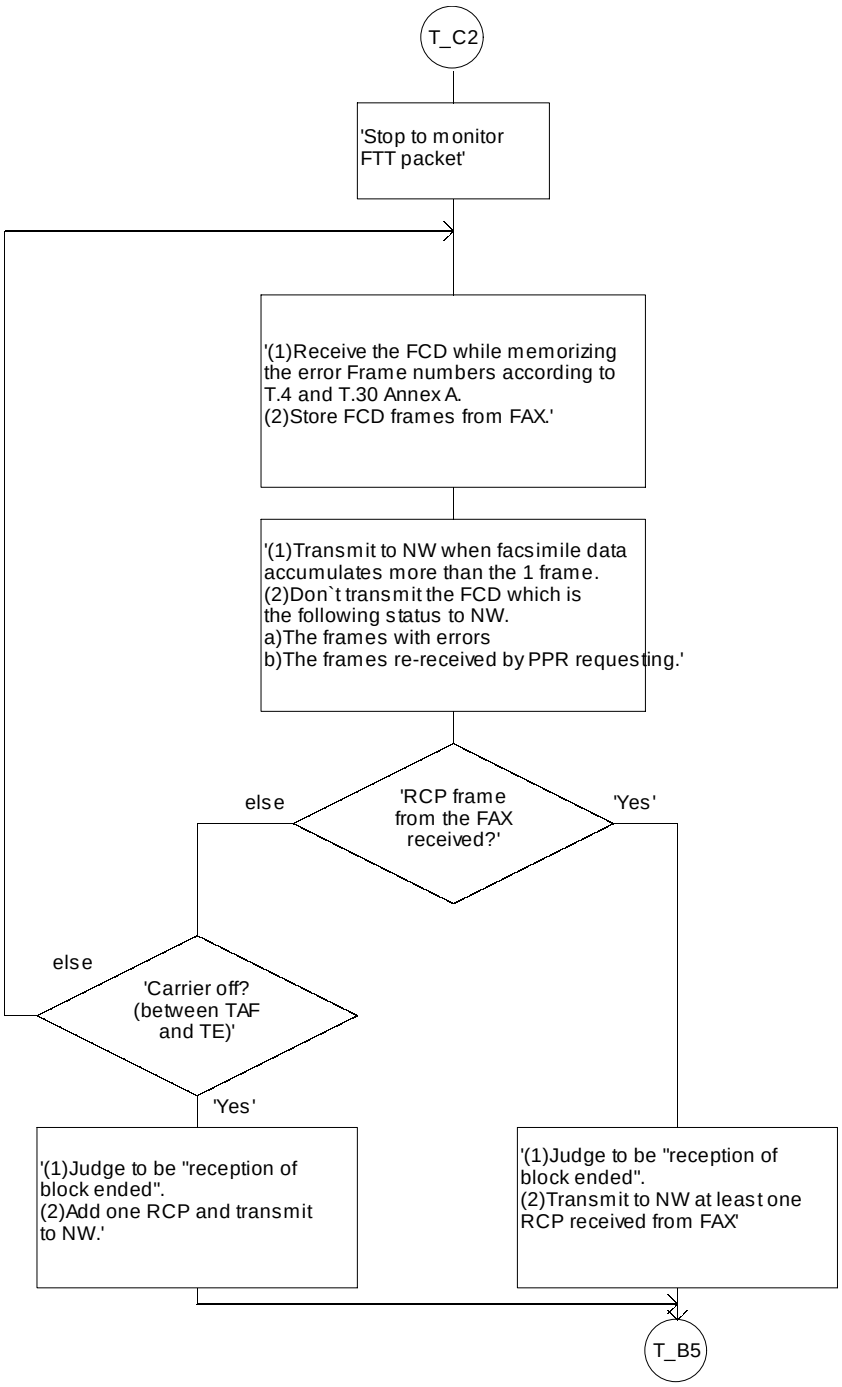



**Figure III.12/23.146: Transmission side TAF, Phase C for ECM**

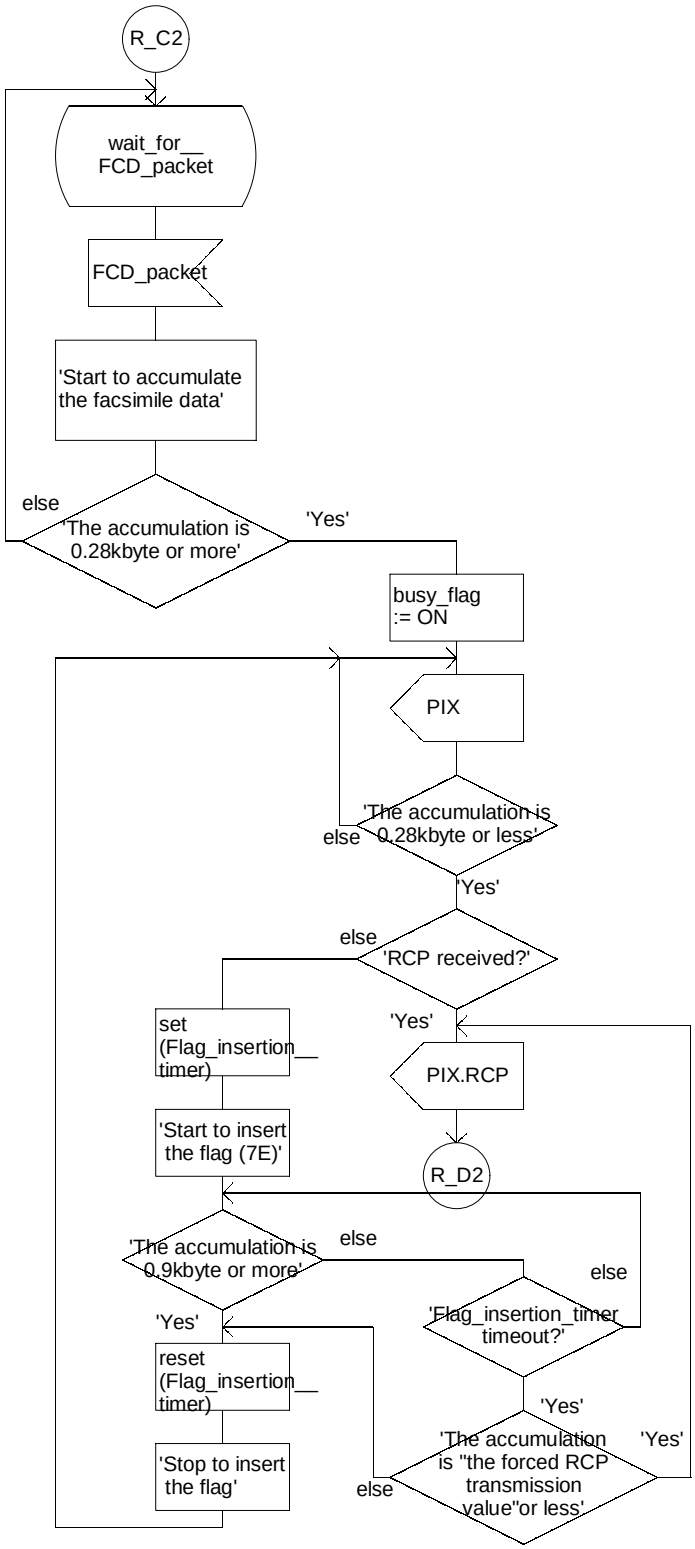



**Figure III.13/23.146: Reception side TAF, phase C for ECM**

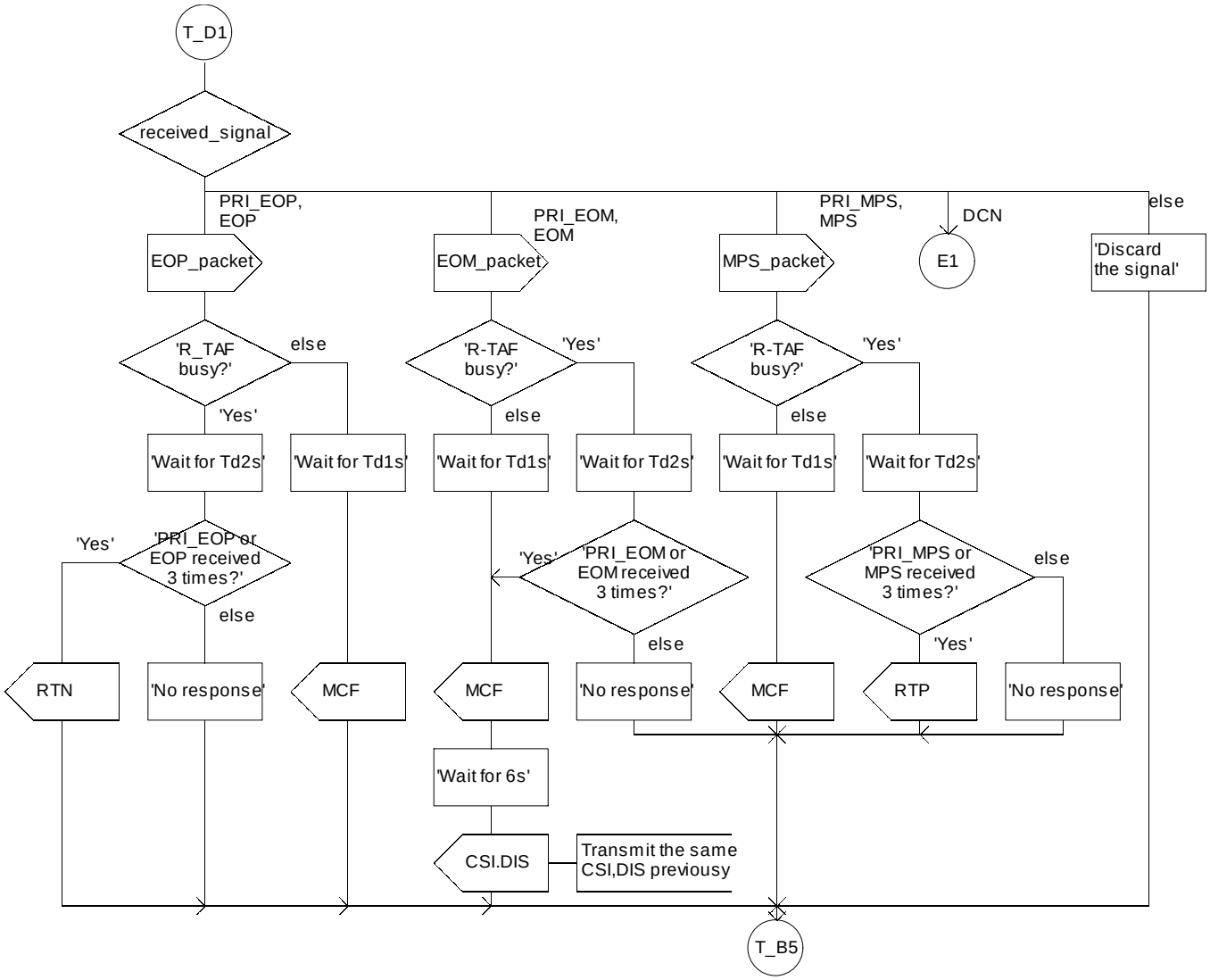



**Figure III.14/23.146: Transmission side TAF for NON ECM, Phase D (Basic control flow)**

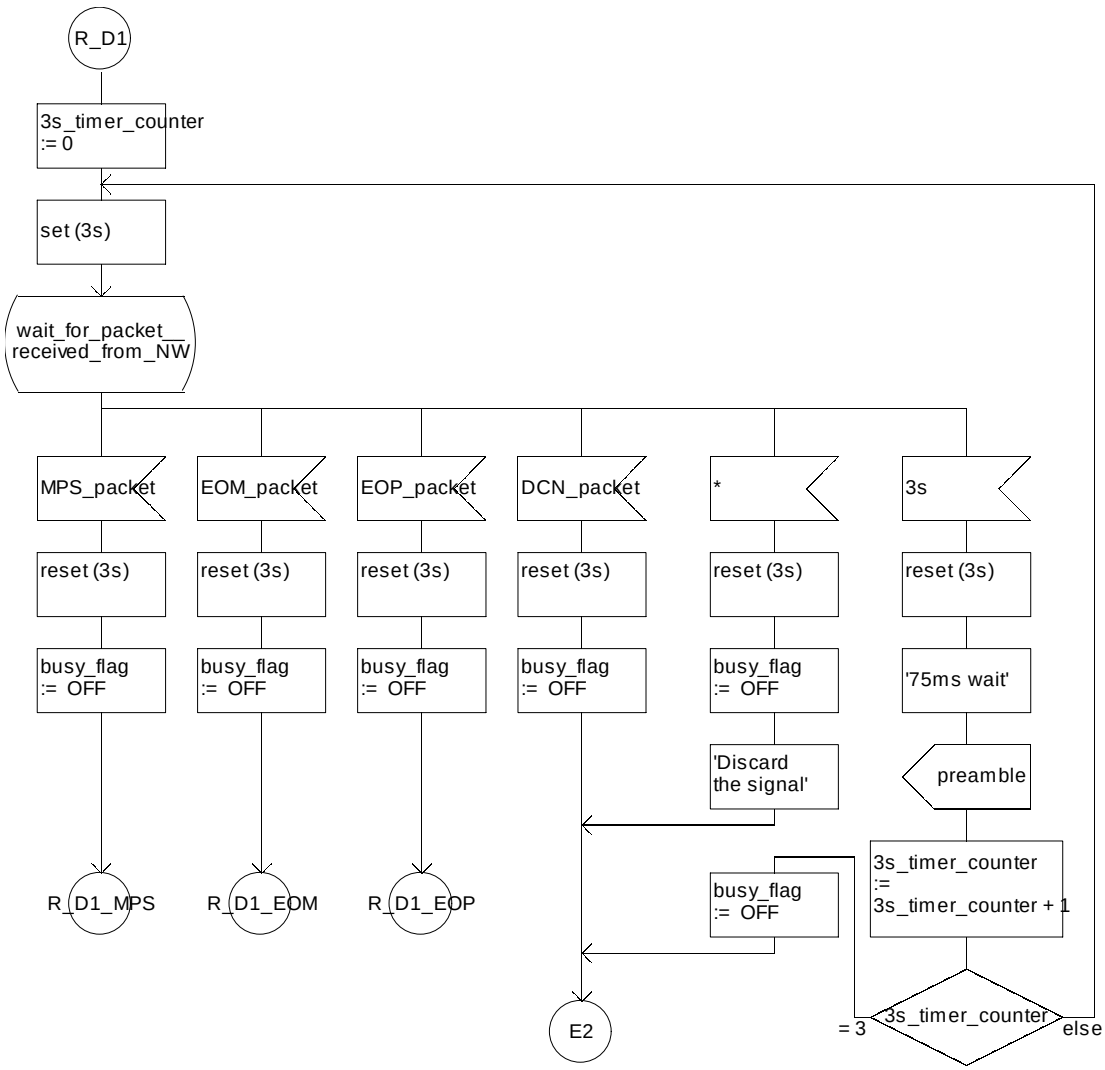



**Figure III.15/23.146: Reception side TAF for NON ECM, Phase D (Basic control flow)**

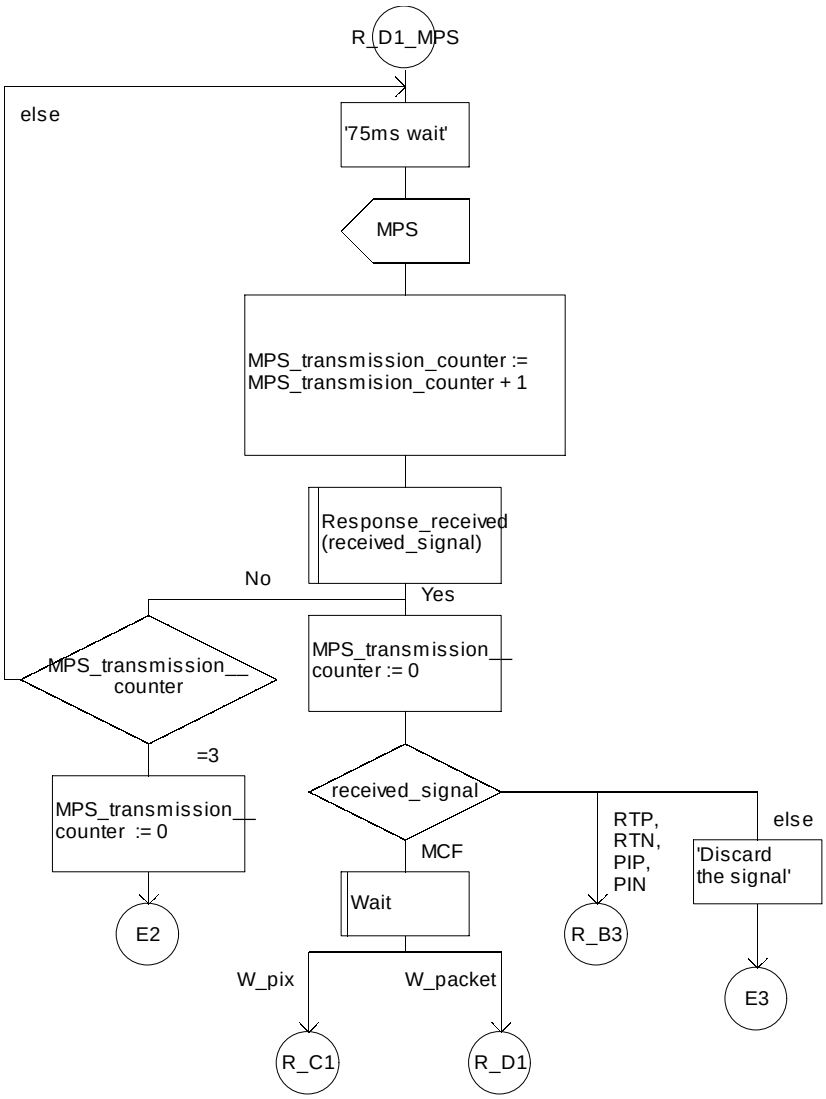



**Figure III.16/23.146: Reception TAF, Phase D (MPS)**

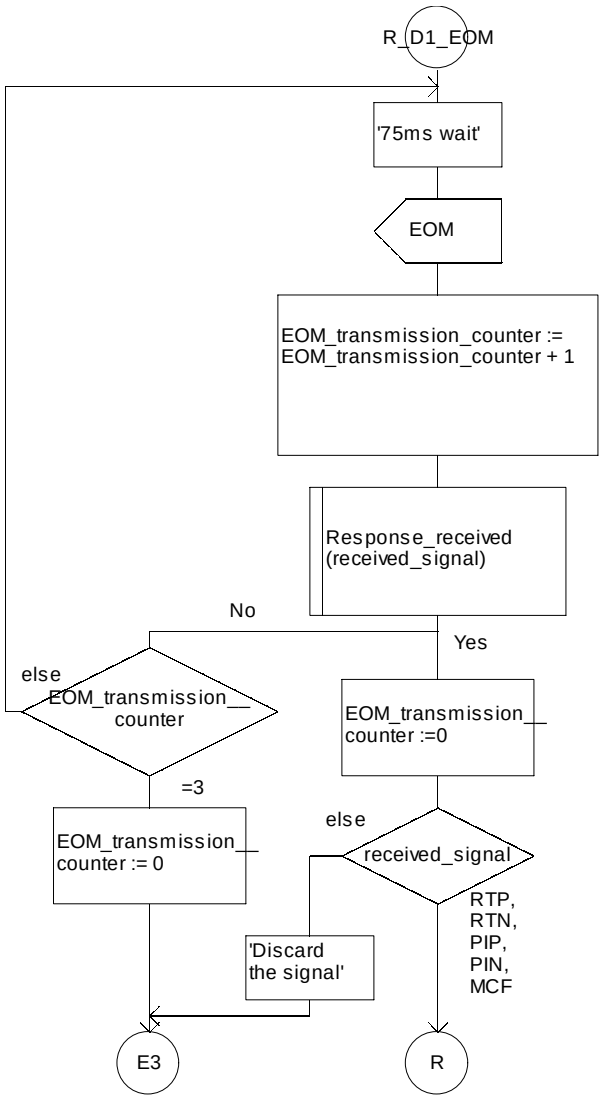



**Figure III.17/23.146: Reception TAF, Phase D (EOM)**

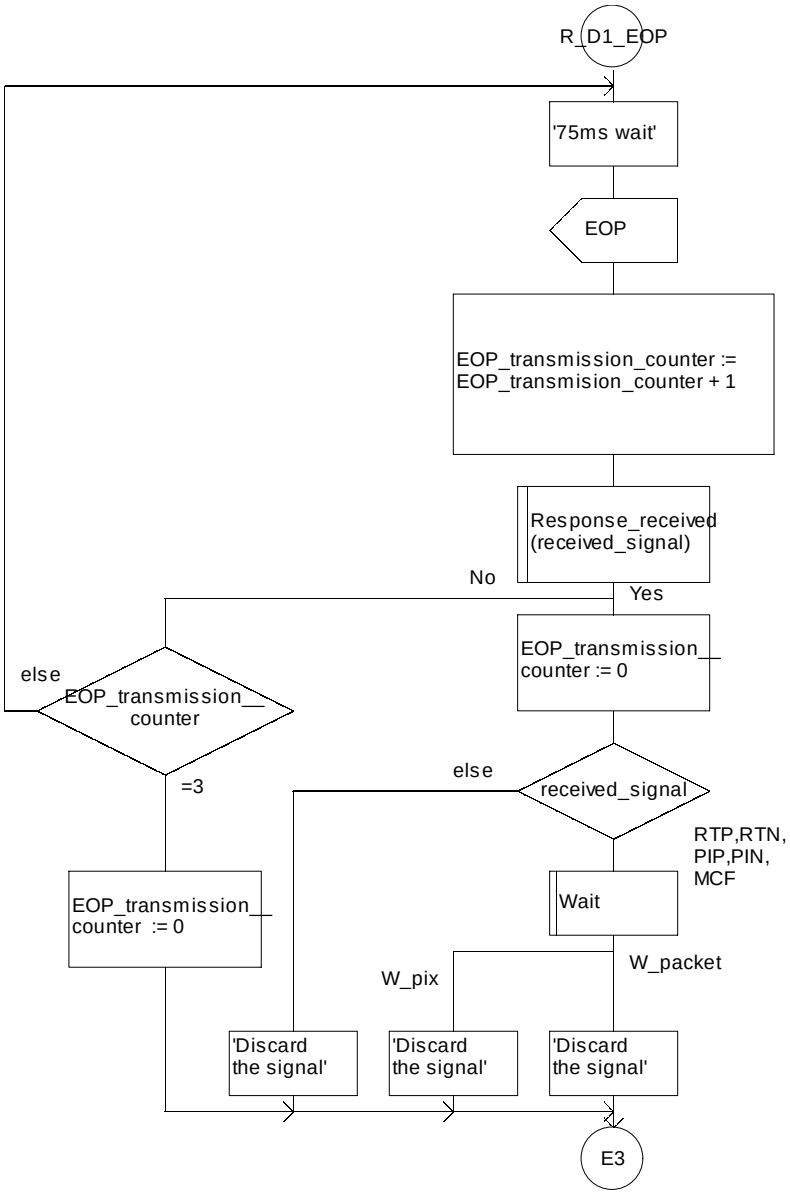



**Figure III.18/23.146:•Reception TAF, Phase D (EOP)**

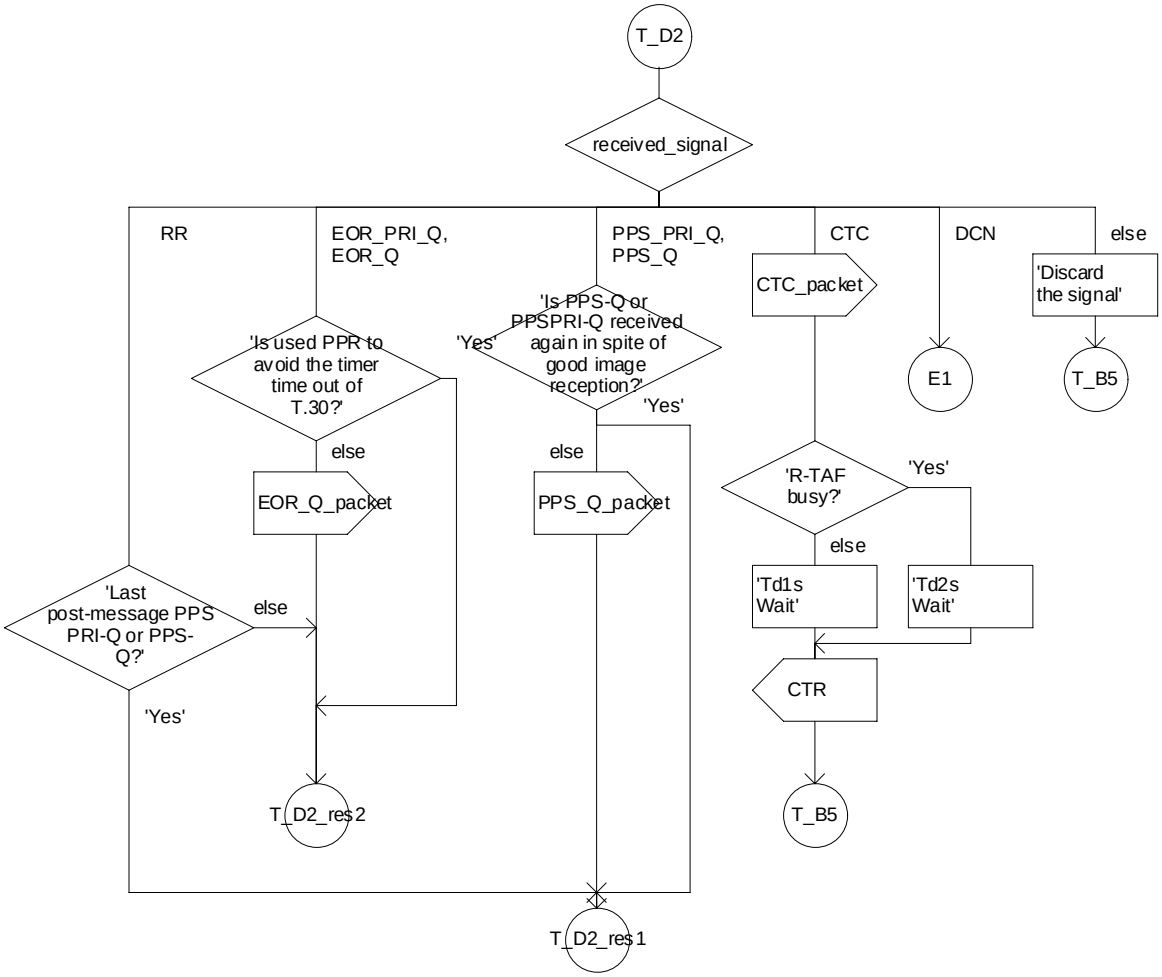



**Figure III.19/23.146:•Transmission side TAF for ECM, Phase D (Basic control flow)**

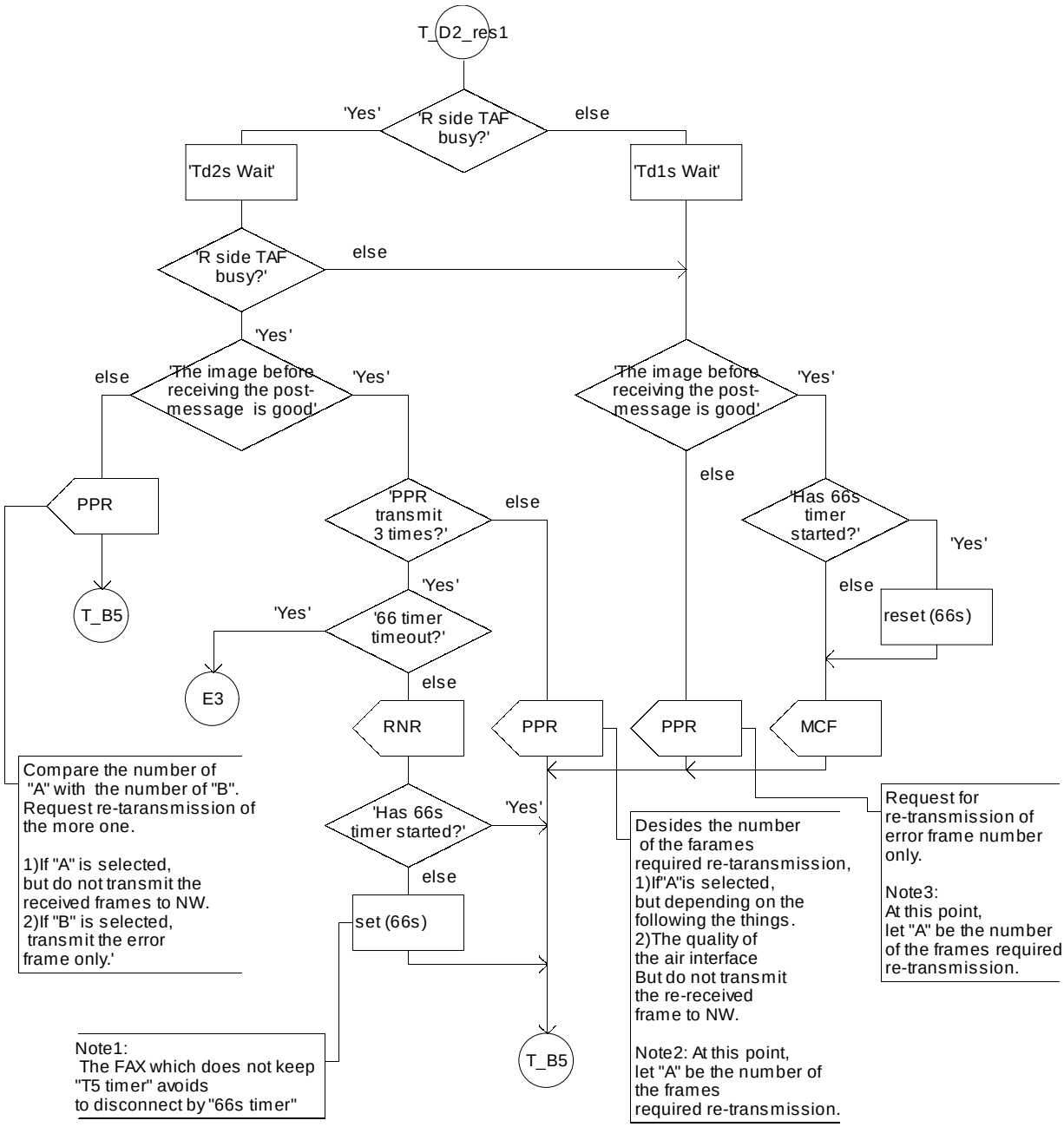



**Figure III.20/23.146: Selection algorithm for MCF/PPR/RNR**

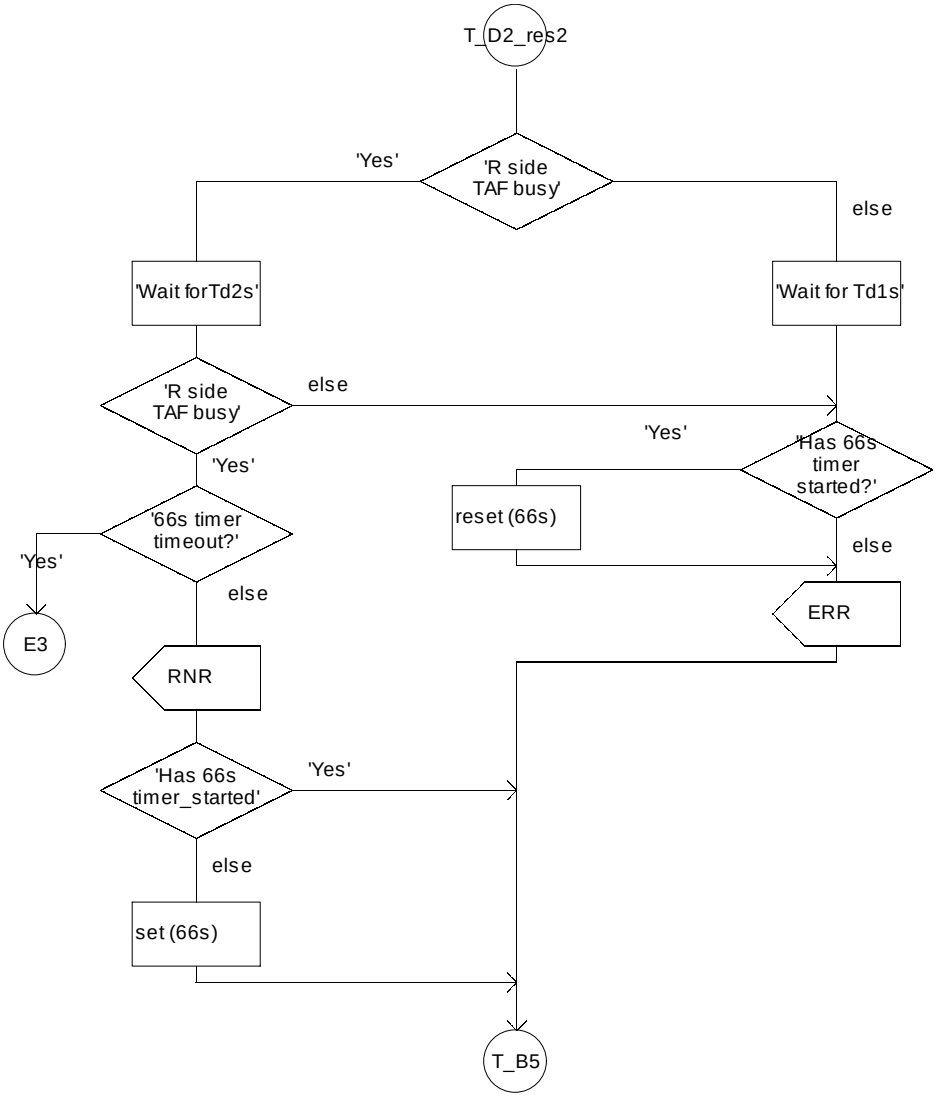



**Figure III.21/23.146: Selection for ERR / RNR ECM**

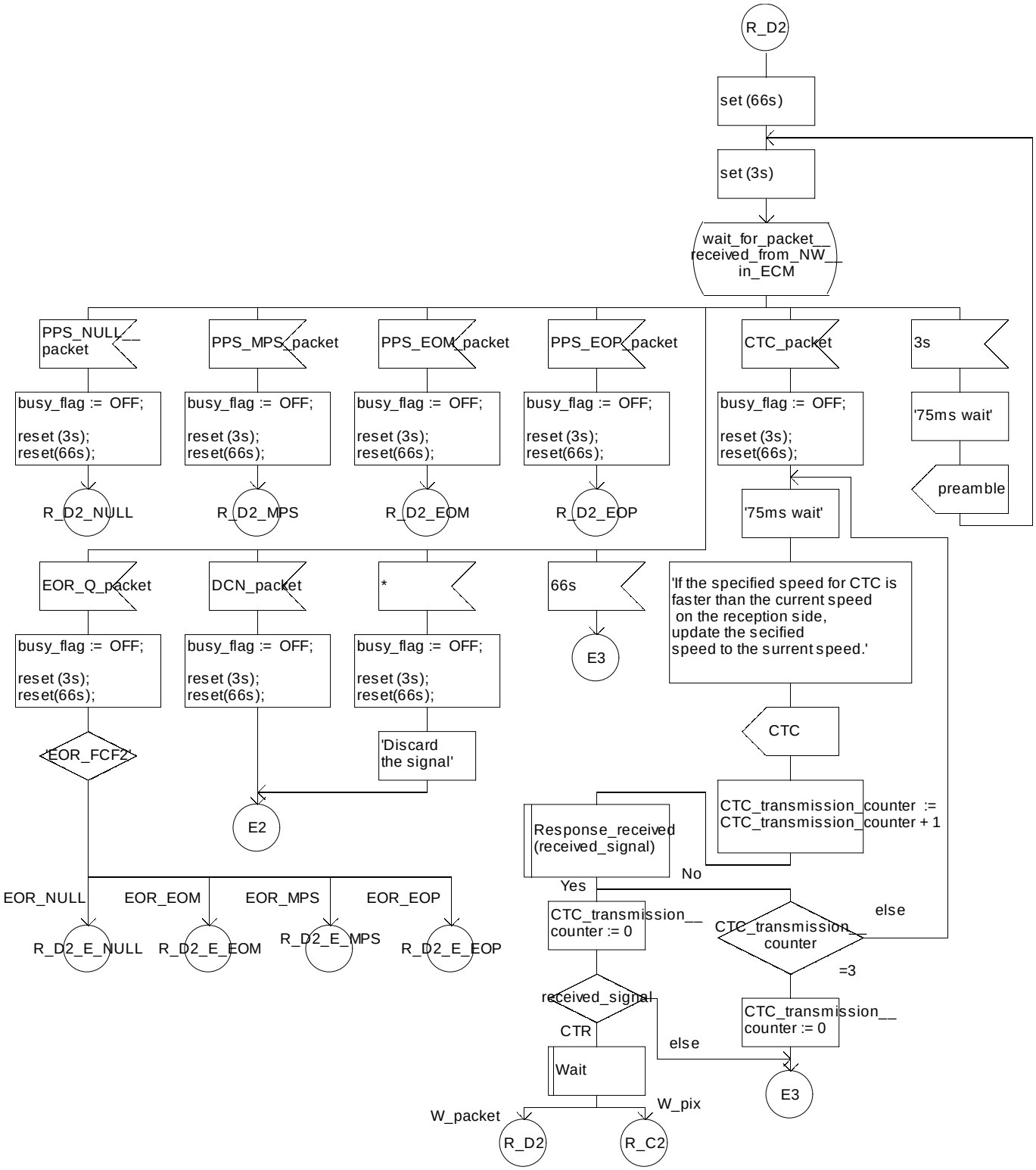



**Figure III.22/23.146: Reception side TAF for ECM, Phase D(Basic control flow)**

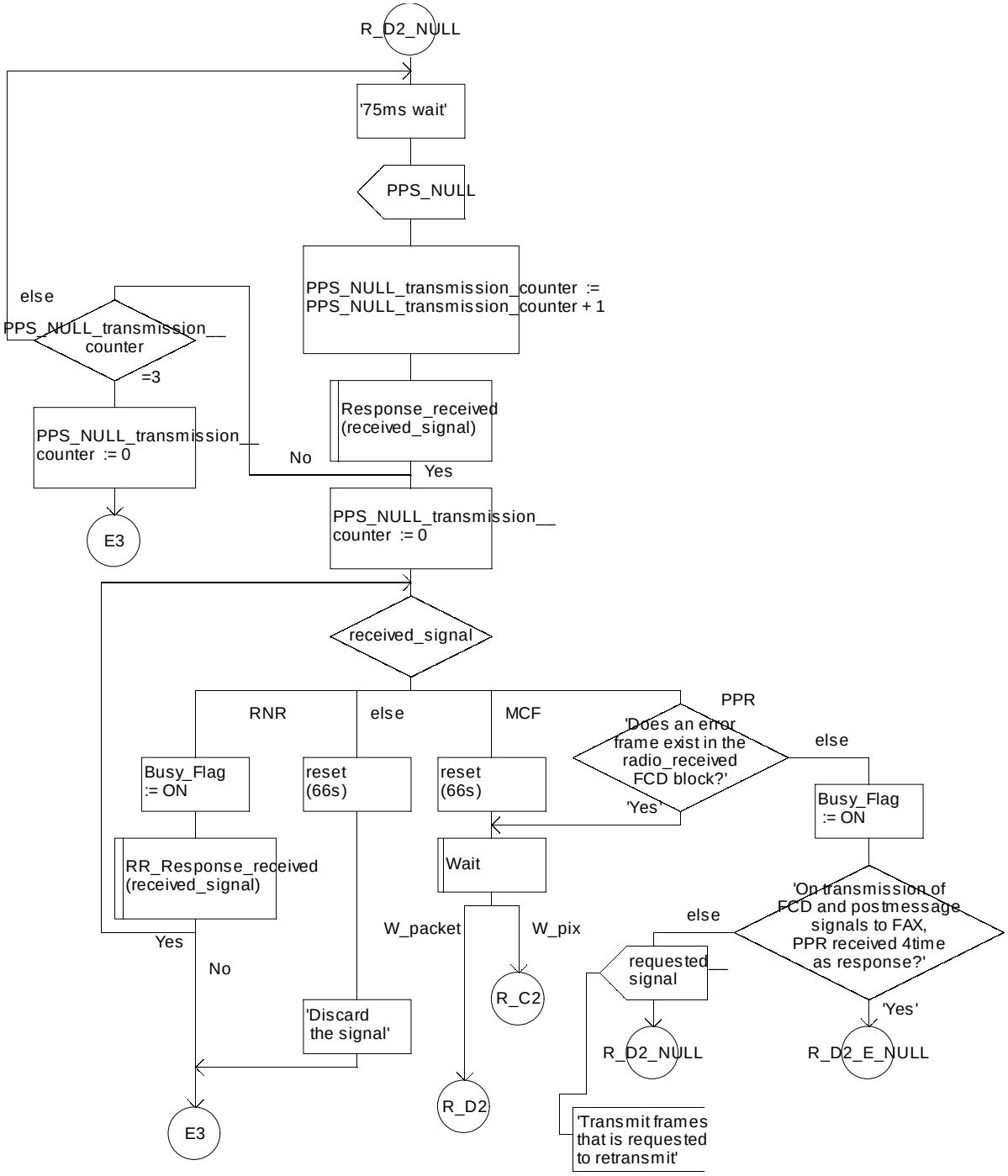



**Figure III.23/23.146:•Reception TAF, Phase D (PPS-NULL)**

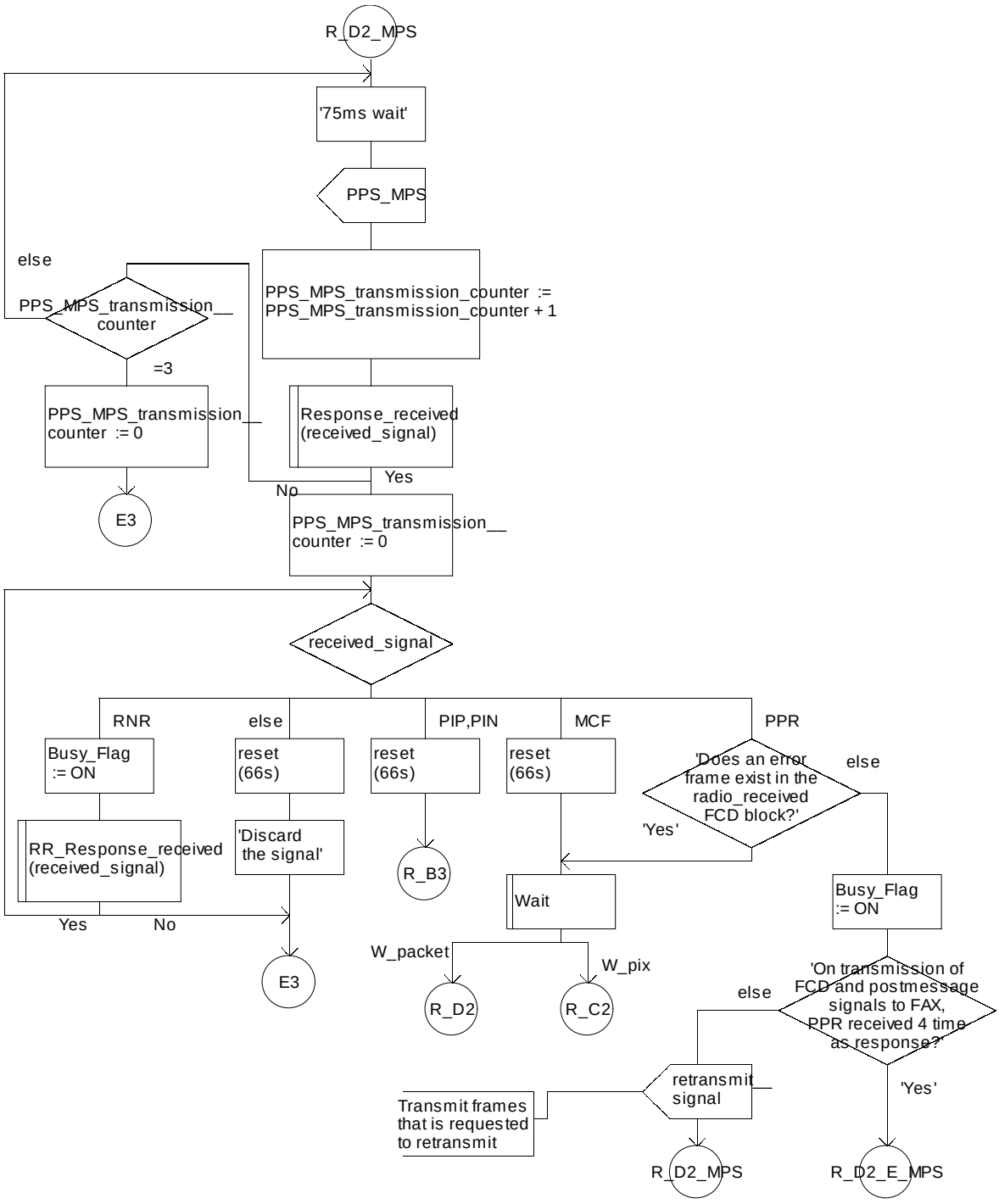



**Figure III.24/23.146: Reception TAF, Phase D (PPS-MPS)**

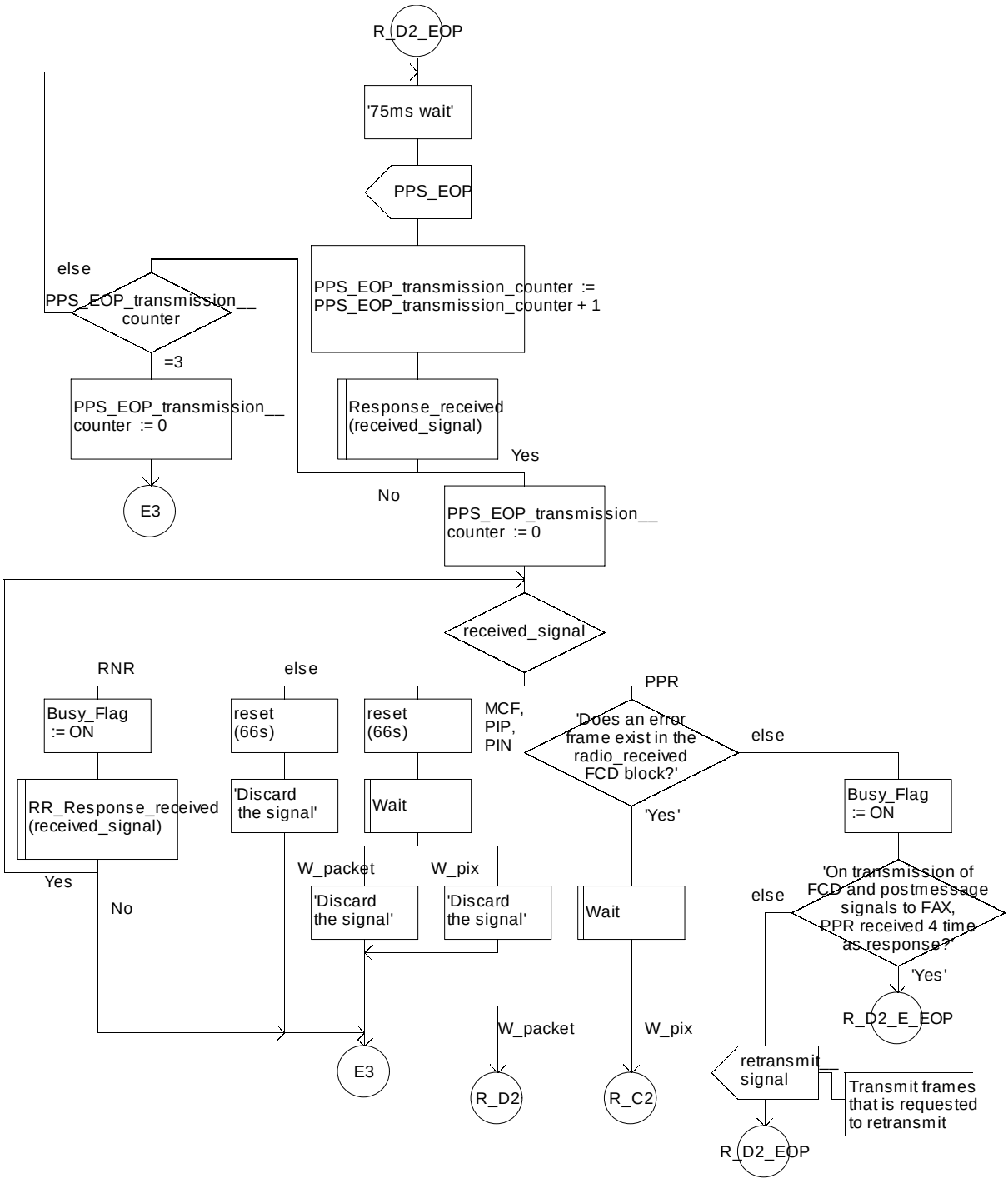



**Figure III.25/23.146:•Reception TAF, Phase D (PPS-EOP)**

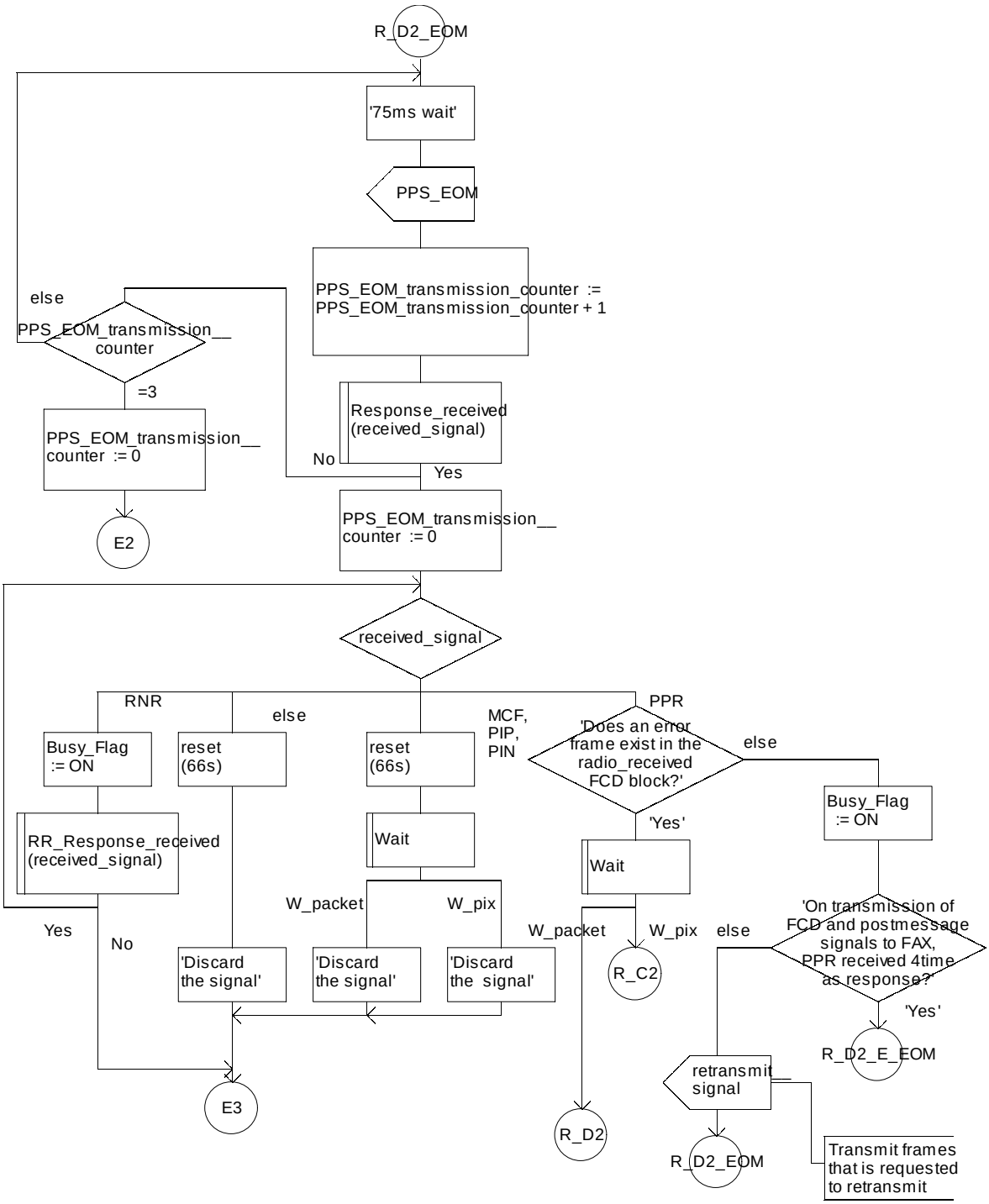



**Figure III.26/23.146: Reception TAF, Phase D (PPS-EOM)**

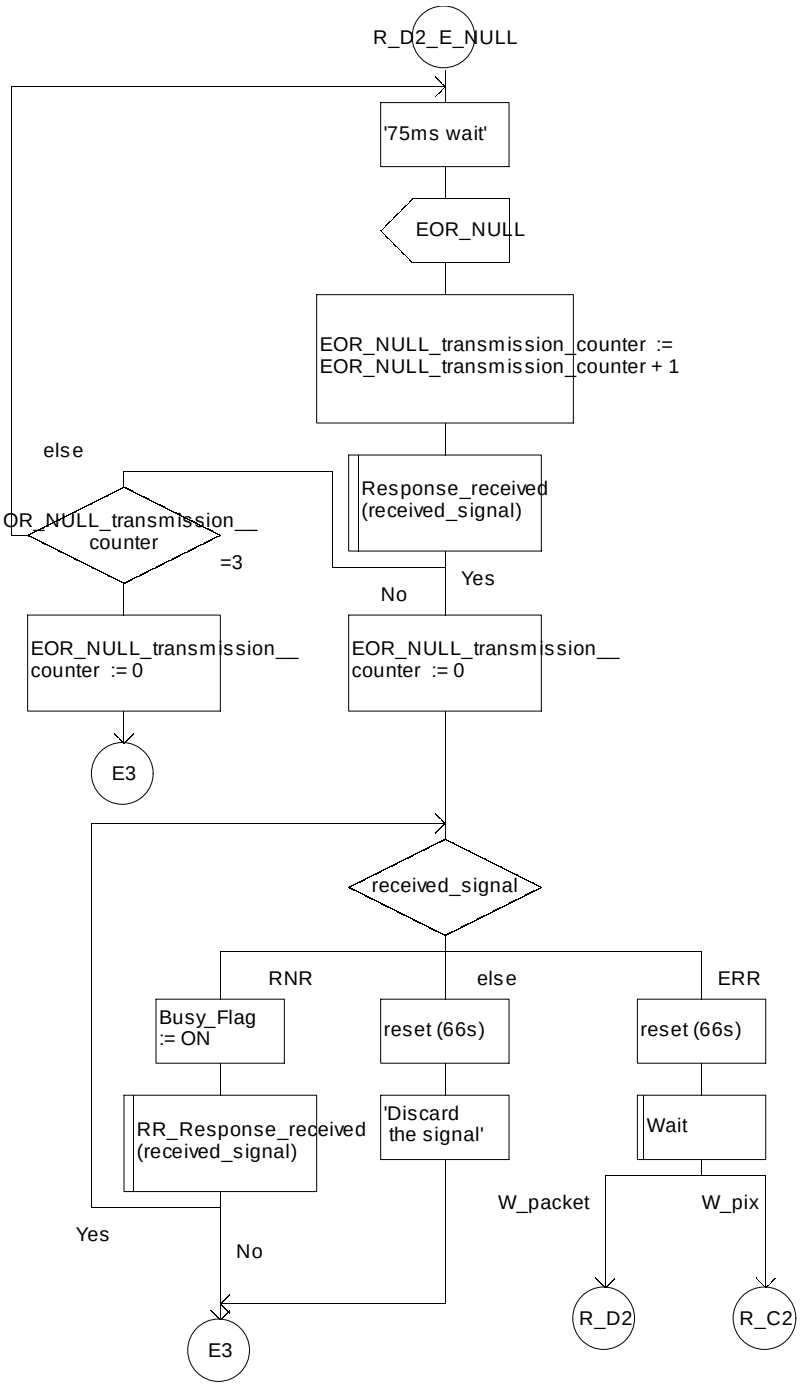



**Figure III.27/23.146:•Reception TAF, Phase D (EOR-NULL)**

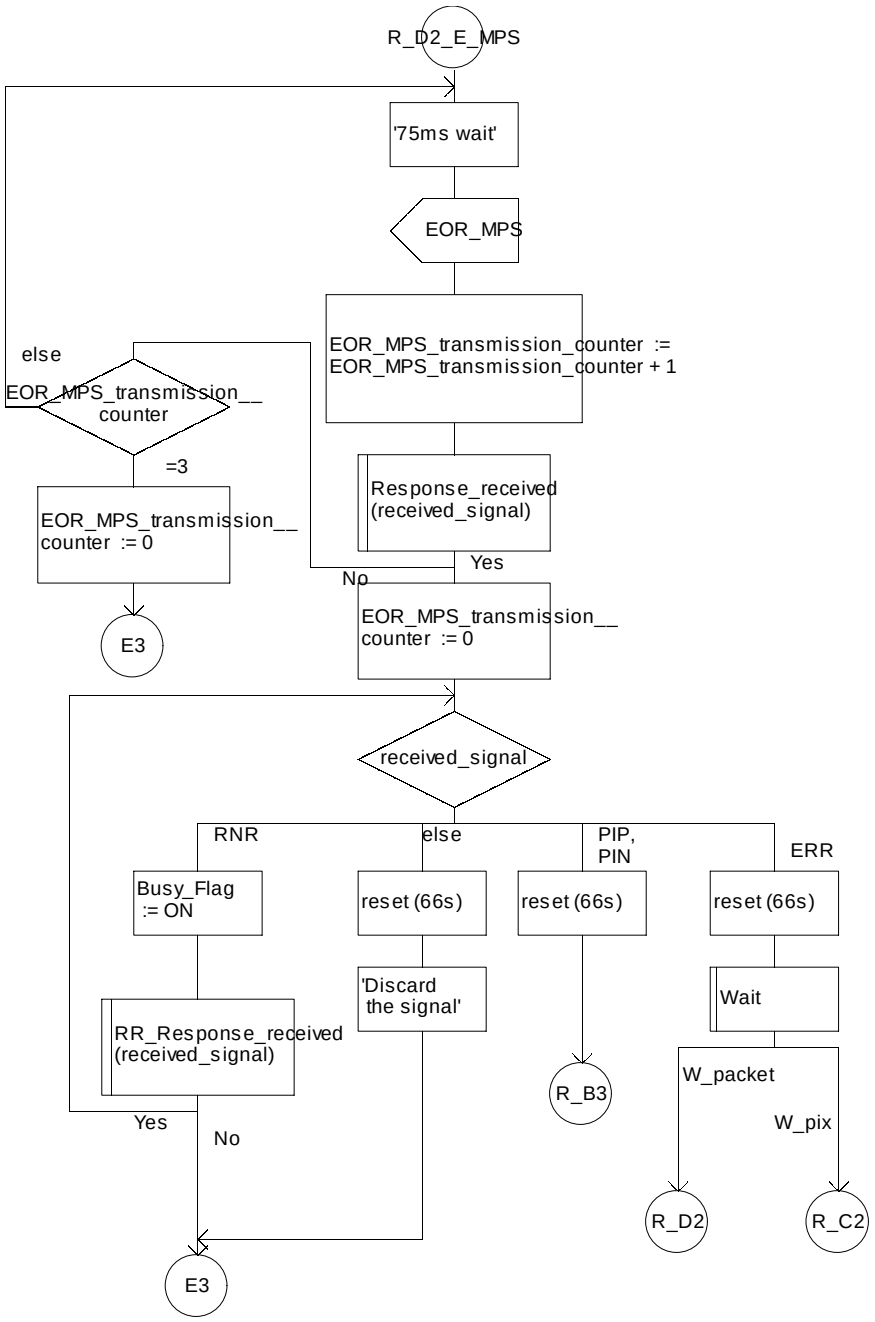



**Figure III.28/23.146:•Reception TAF, Phase D (EOR-MPS)**

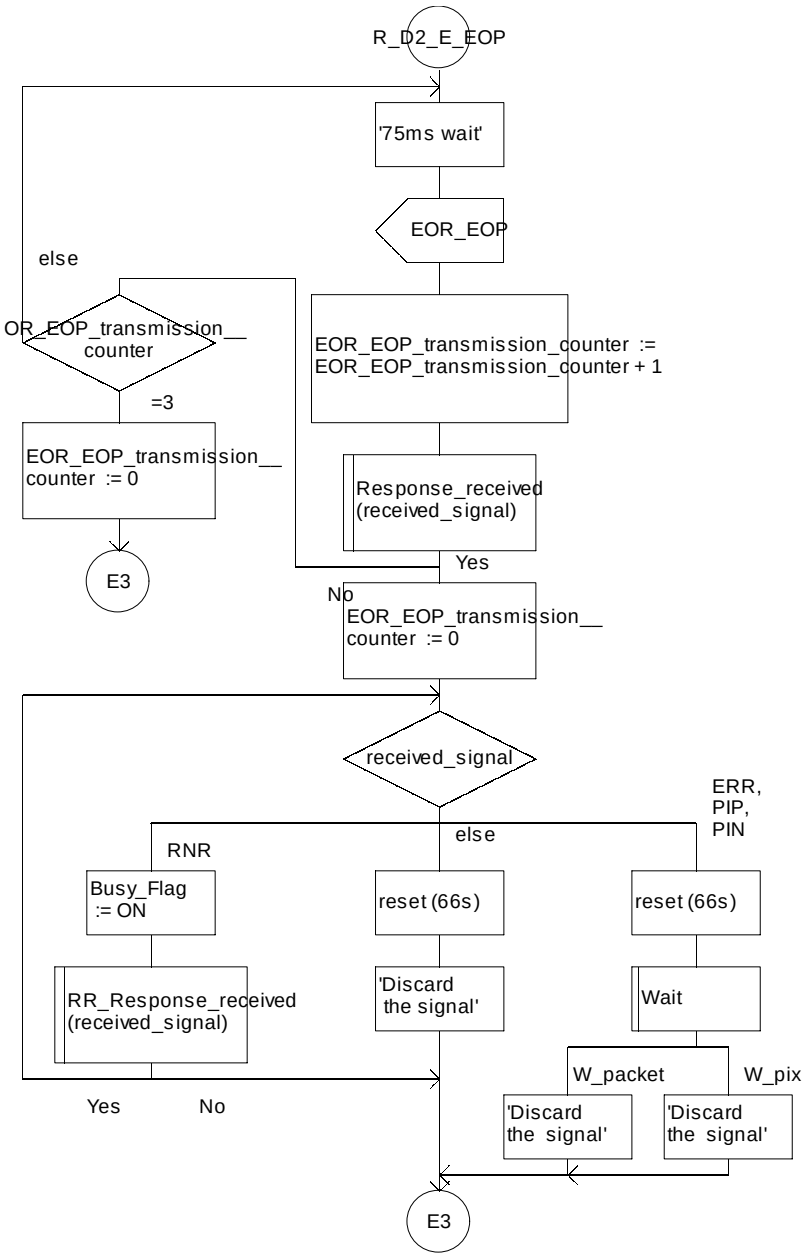



**Figure III.29/23.146: Reception TAF, Phase D (EOR-EOP)**

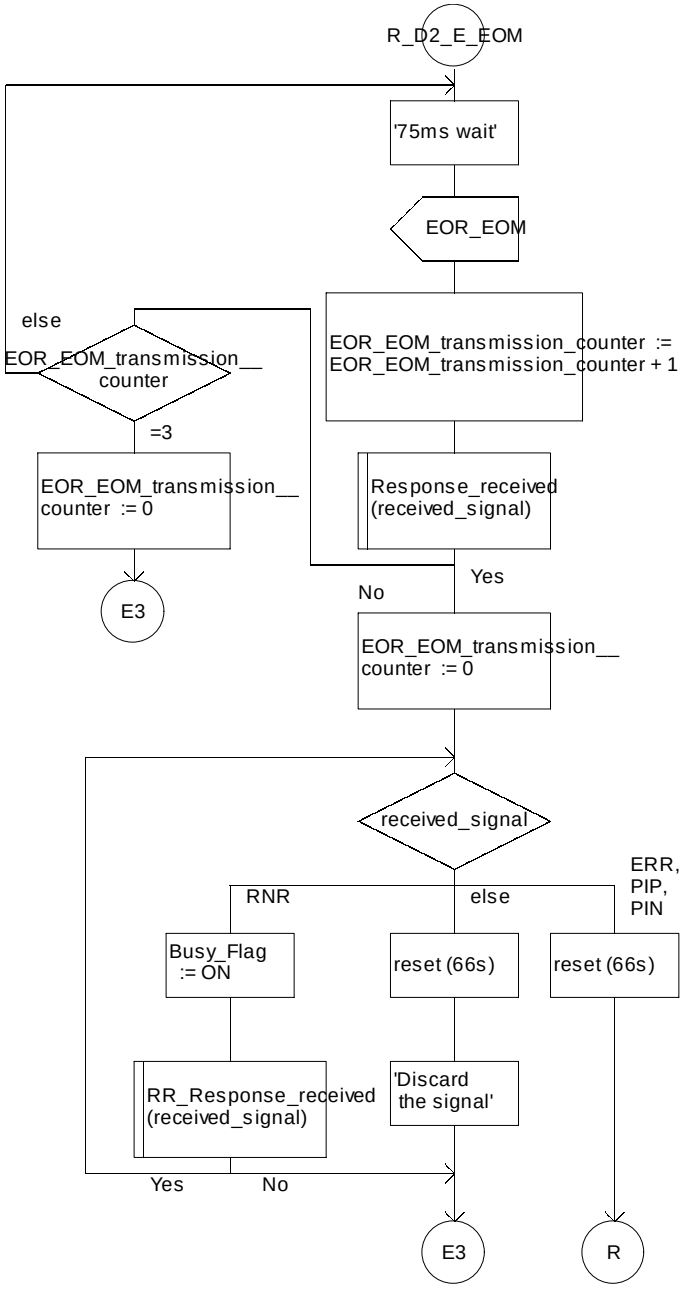



**Figure III.30/23.146: Reception TAF, Phase D (EOR-EOM)**

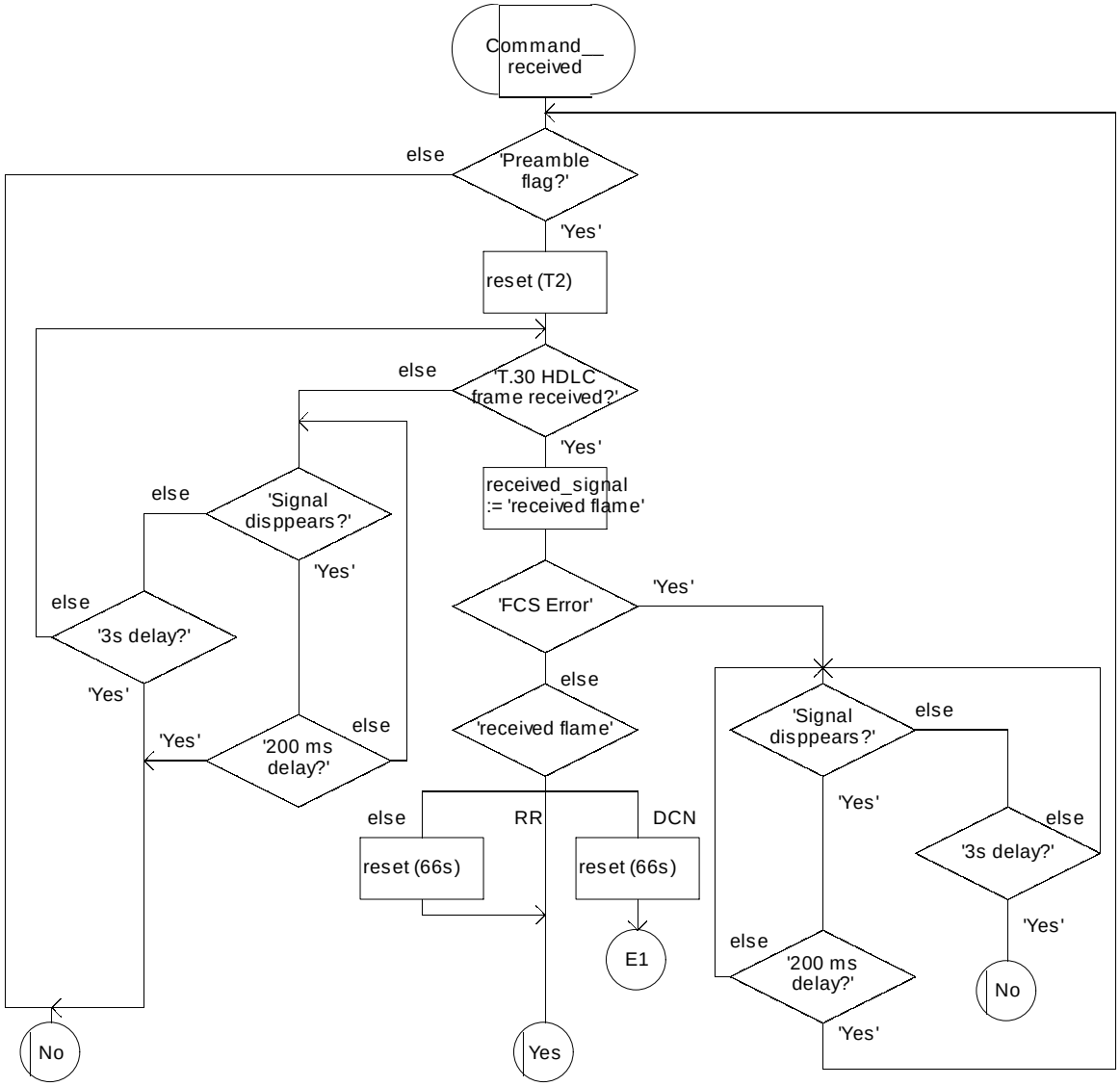



**Figure III.31/23.146: Command reception subroutine**

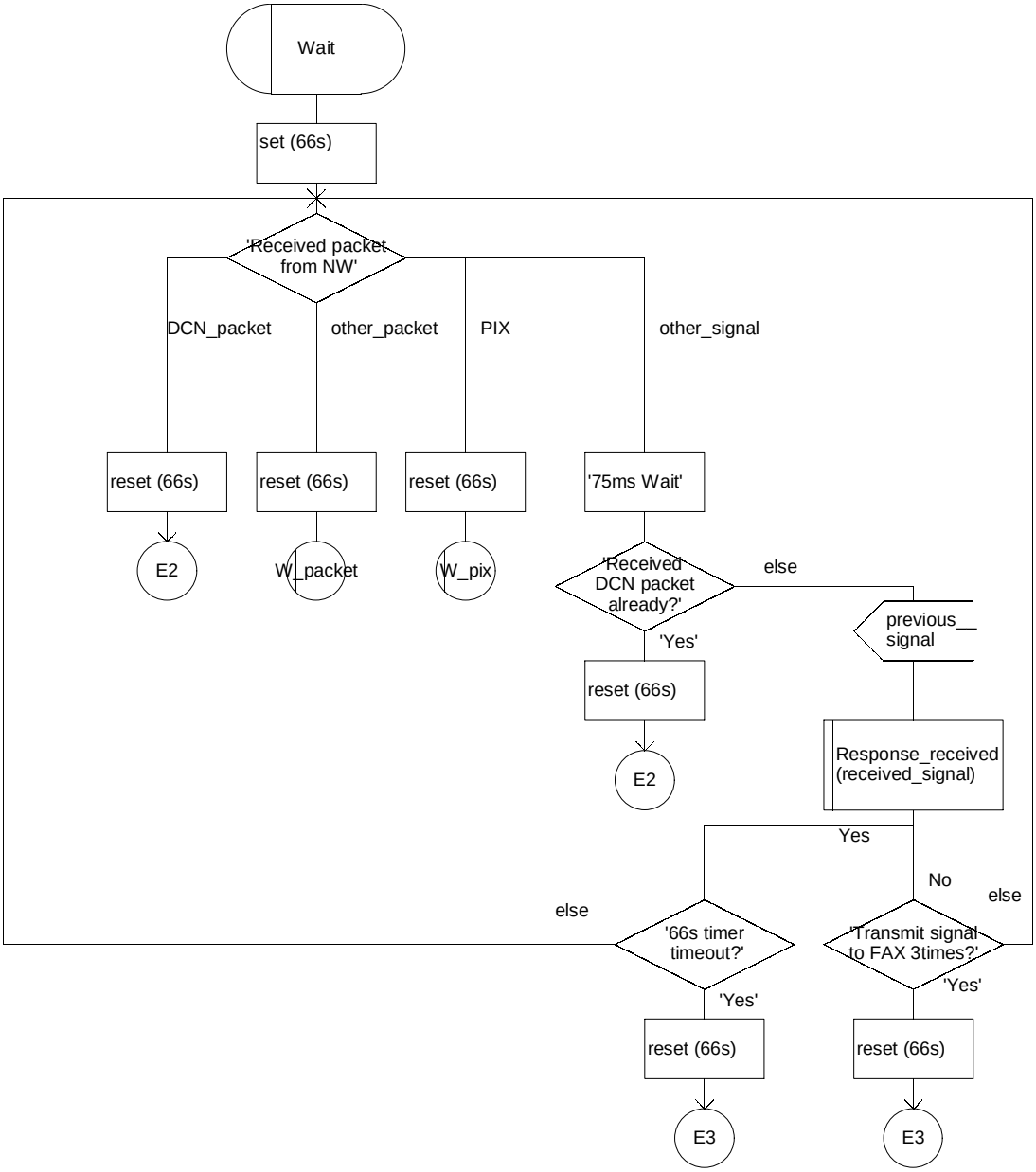



**Figure III.32/23.146: Wait subroutine**

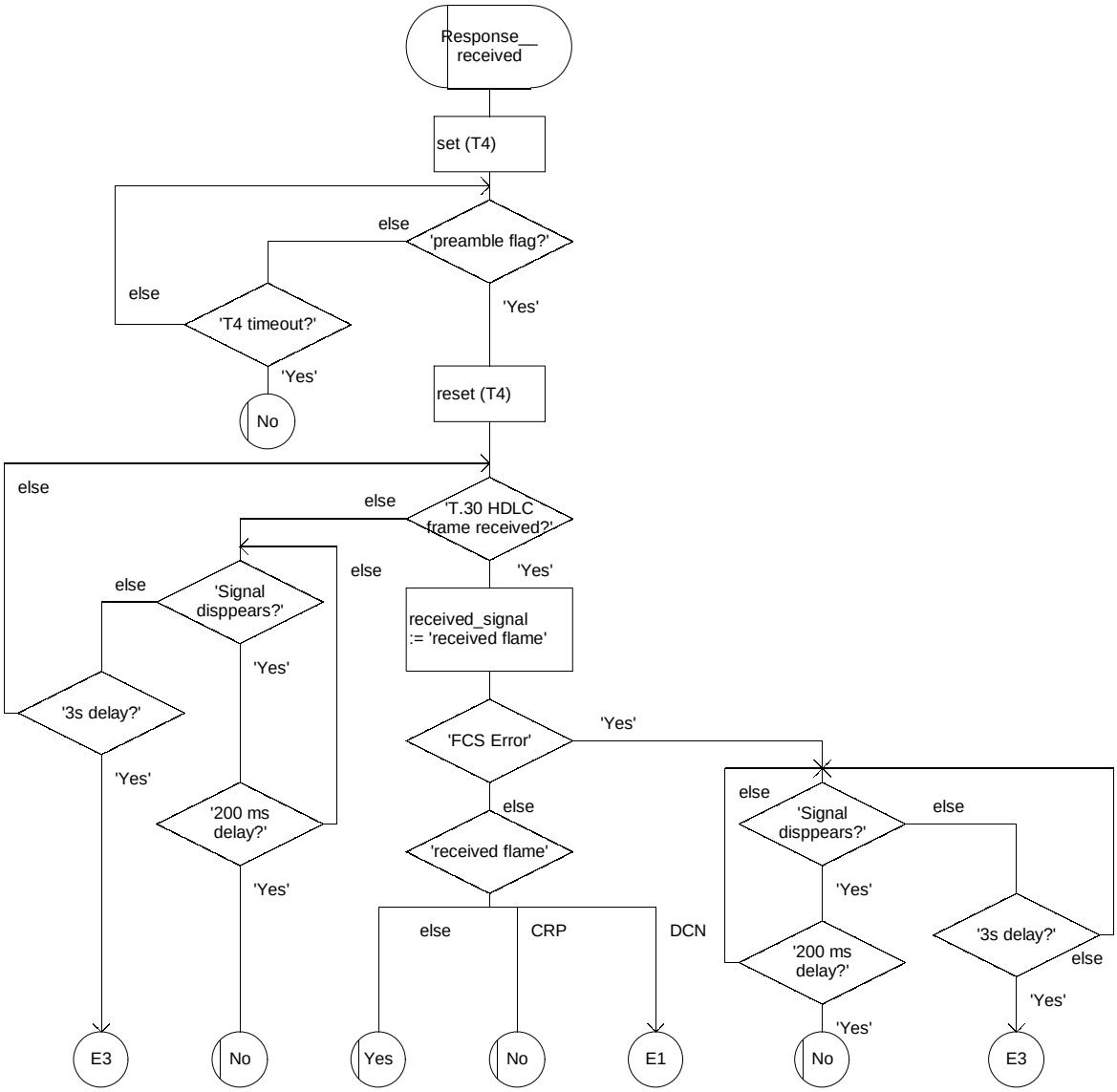



**Figure III.33/23.146: Response reception subroutine**

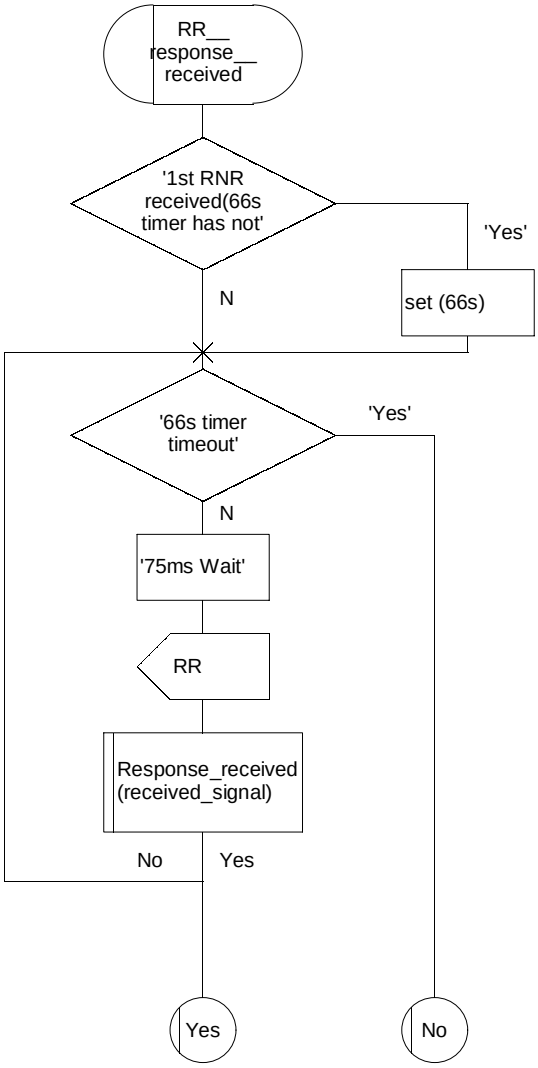



**Figure III.34/23.146: RR response reception subroutine**

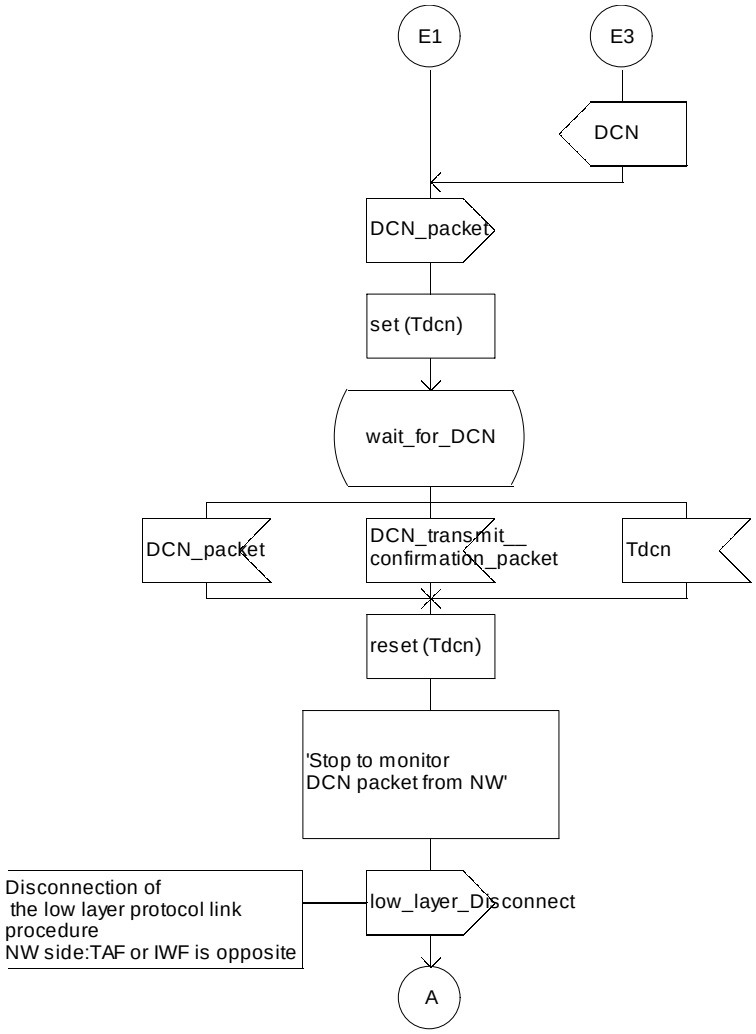



**Figure III.35/23.146: TAF release flow (1)**

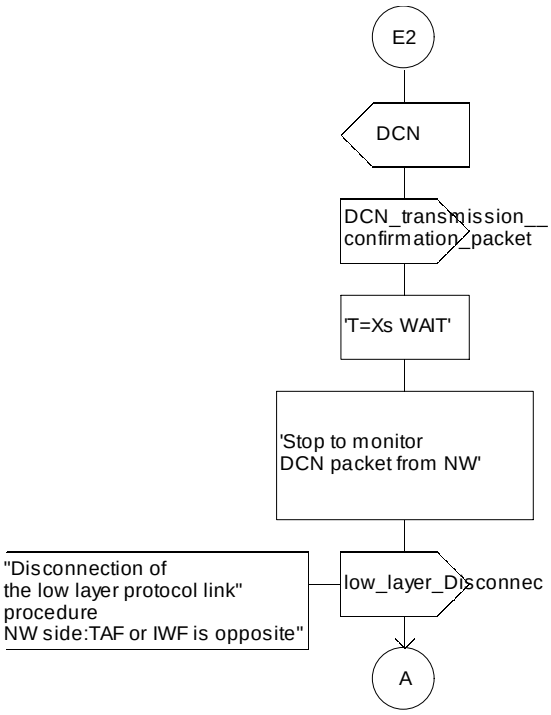



**Figure III.36/23.146: TAF release flow (2)**

# Annex B (informative): Change history

| TSG CN# | Spec | Version | CR | <Phase> | New Version | Subject/Comment |
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# History

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