INTERNATIONAL TELECOMMUNICATION UNION

CCITT X.38

THE INTERNATIONAL
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CONSULTATIVE COMMITTEE

DATA COMMUNICATION NETWORKS: SERVICES AND FACILITIES, INTERFACES

G3 FACSIMILE EQUIPMENT/DCE INTERFACE FOR G3 FACSIMILE EQUIPMENT ACCESSING THE FACSIMILE PACKET ASSEMBLY/ DISASSEMBLY FACILITY (FPAD) IN A PUBLIC DATA NETWORK SITUATED IN THE SAME COUNTRY

Recommendation X.38

Geneva, 1992

FOREWORD

The CCITT (the International Telegraph and Telephone Consultative Committee) is a permanent organ of the International Telecommunication Union (ITU). CCITT is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The Plenary Assembly of CCITT which meets every four years, establishes the topics for study and approves Recommendations prepared by its Study Groups. The approval of Recommendations by the members of CCITT between Plenary Assemblies is covered by the procedure laid down in CCITT Resolution No. 2 (Melbourne, 1988).

Recommendation X.38 was prepared by Study Group VII and was approved under the Resolution No. 2 procedure on the 10th of February 1992.

CCITT NOTES

1) In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication Administration and a recognized private operating agency.

2) A list of abbreviations used in this Recommendation can be found in Appendix II.

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Recommendation X.38

G3 FACSIMILE EQUIPMENT/DCE INTERFACE FOR G3 FACSIMILE EQUIPMENT ACCESSING THE FACSIMILE PACKET ASSEMBLY/DISASSEMBLY FACILITY (FPAD) IN A PUBLIC DATA NETWORK SITUATED IN THE SAME COUNTRY

(*Geneva, 1991*)

Preface

The establishment in various countries of public data networks providing packet switched data transmission services creates a need to produce standards to facilitate G3 facsimile equipment access from the telephone network.

The CCITT,

considering

(a) that Recommendations X.1 and X.2 define user classes of service and user facilities provided by a public data network and Recommendation X.96 defines call progress signals;

(b) that Recommendation X.39 defines procedures for a packet mode DTE to control the FPAD and for interworking between FPADs;

(c) that Recommendation X.5 defines the facsimile packet assembly/disassembly (FPAD) facility in a public data network;

(d) that the logical control links for packet switched data transmission services are defined in Recommendation X.92;

(e) that G3 facsimile or associated equipments may send and receive network control information and user information in the form of dual-tone multi-frequency codes defined in Recommendation Q.23 or signals defined in Recommendations T.4 and T.30,

unanimously declares

that the necessary elements for an interface Recommendation should be as defined independently as:

a) § 1: Procedures for establishment of a national access information path between a G3 facsimile equipment and an FPAD;

b) § 2: Procedures for service initialization between a G3 facsimile equipment and an FPAD;

c) § 3: Procedures for the exchange of control information between a G3 facsimile equipment and an FPAD;

d) § 4: Procedures for the exchange of facsimile image data between a G3 facsimile equipment and an FPAD.

1 Procedures for the establishment of a national access information path (AIP) between a G3 facsimile equipment (G3FE) (see Note) and an FPAD

Note – The term G3 facsimile equipment used in this Recommendation is slightly different from the T-Series Recommendations. In this Recommendation it is taken to be a G3 facsimile equipment which conforms to Recommendations T.4 and T.30, along with the necessary ancillary control device as described in § 2.1.1.

Two different access information paths are defined:

– from a G3 facsimile equipment to an FPAD, and

– from an FPAD to a G3 facsimile equipment.

In each case, the G3 facsimile equipment may be connected directly to an FPAD or may be connected to the FPAD via the general switched telephone network (GSTN).

Recognizing that the insertion of a FPAD on the GSTN may result in limitations on the interchange of facsimile images between Group 3 facsimile terminals, the introduction of the FPAD should only occur as the result of an explicit act by either the call originator or the call recipient.

1.1 *Access from a G3 facsimile equipment to an FPAD*

1.1.1 *For an equipment connected to the GSTN*

1.1.1.1 *Two-stage dialling*

For two-stage dialling, the establishment of the call is based on manual operation of the G3 facsimile equipment, although automatic operation may also be feasible.

The calling equipment accesses an FPAD by dialling a number assigned to the FPAD. When the FPAD answers the call, the state of the FPAD changes from the disconnected state to the active link state (§ 2.2.2) (when FPAD parameter 1 is not set to 0) or to the FPAD waiting state (§ 3.2.1.1) (when FPAD parameter 1 is set to 0).

1.1.1.2 *One-stage dialling*

For one-stage dialling, the establishment of a call is realized through either manual or automatic operation of the G3 facsimile equipment. The FPAD to which the calling G3 facsimile equipment is connected, behaves as a called equipment operating automatically. (See Recommendation T.30 operating methods 2 and 4.)

The calling G3 facsimile equipment dials the number of the called facsimile equipment, but instead of establishing a connection with the called equipment, the GSTN routes the call to an FPAD. The means by which the GSTN determines that the call can be routed to an FPAD, and the means by which the called equipment is identified to the FPAD are local matters.

Once the FPAD has received the dial number of the called equipment from the GSTN, the state of the FPAD changes from disconnected state (§ 2.2.1) to connection-in-progress state (§ 3.2.1.4).

1.1.2 *For a directly connected equipment*

The calling G3 facsimile equipment may operate manually or automatically. In the case of an equipment operating automatically, the FPAD is required to emulate the GSTN. Therefore the FPAD must provide dial tone and other service signals as defined in § 3.4.2.

After the calling G3 facsimile equipment goes off-hook, the state of the FPAD immediately changes from the disconnected state (§ 2.2.1) to the active link state (§ 2.2.2) (when FPAD parameter 1 is not set to 0) or to the FPAD waiting state (§ 3.2.1.1) (when FPAD parameter 1 is set to 0).

1.2 *Access from an FPAD to a G3 facsimile equipment*

1.2.1 *For an equipment connected to the GSTN*

The procedures are as defined in Recommendation T.30 for call establishment between a calling equipment operating automatically and a called equipment operating either manually or automatically (i.e. operating methods 3 and 4).

The address of the called equipment is derived from the called address field of the incoming call packet. It is the responsibility of the FPAD to derive a dial number which is consistent with both the context of the FPAD and the local requirements of the GSTN.

Upon receipt of a CED signal or (CSI)-DIS command from the called G3 facsimile equipment, the interface enters the facsimile procedure state (§ 4.1).

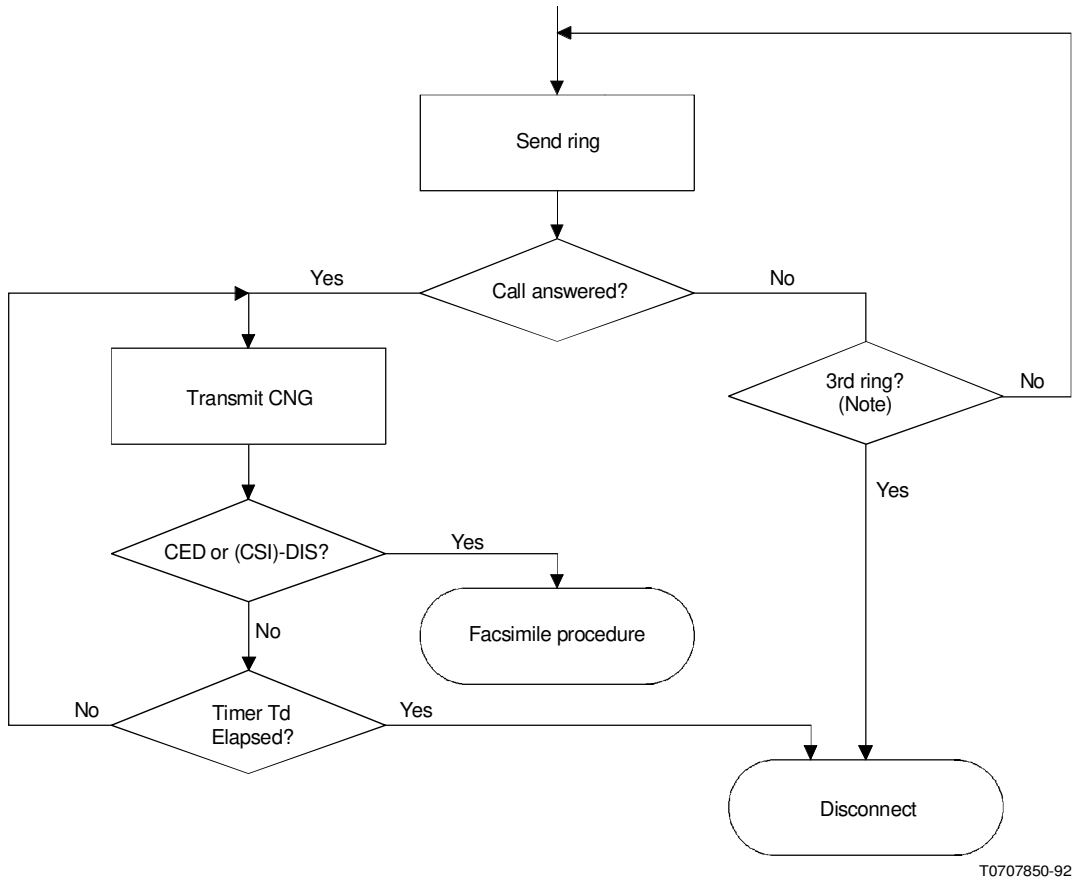
Note – In the balance of this Recommendation, (NSF) may preceed (CSI)-DIS. The handling of non-standard facilities is described in § 4.3.

1.2.2 *For a directly connected equipment*

1.2.2.1 *FPAD procedures*

An FPAD will emulate the actions of the GSTN in establishing the access information path to a directly connected facsimile equipment. The actions specific to the FPAD are defined in Figure 1/X.38.

The address of the called equipment (represented by the called address field in the incoming call packet) is used by the FPAD to identify the directly connected equipment.



Note – The actual number of rings is a national matter.

FIGURE 1/X.38

Call establishment from an FPAD to a directly connected facsimile equipment (FPAD procedures)

1.2.2.2 *Called G3 facsimile equipment procedures*

The procedures are as defined for the called equipment in Recommendation T.30 for call establishment between a calling equipment operating automatically and a called equipment operating either manually or automatically (i.e. the called equipment procedures of operating methods 3 and 4).

1.3 *Manual operation both at the emitting and receiving G3 facsimile equipments*

A manual operation (operating method 1) both at the emitting and receiving G3 facsimile equipments will be realized by the combination of manual-automatic operation (operating method 2) between an emitting G3 facsimile equipment and FPAD and automatic-manual operation (operating method 3) between a receiving FPAD and G3 facsimile equipment.

It should be noted that true manual-to-manual (Mode 1) operation cannot be realized when using FPADs due to verbal exchange not being possible. However, manual-to-manual (Mode 1) is effected with FPADs by the use of back-to-back Method 2 ↔ Method 3 (Manual to Automatic ↔ Automatic to Manual) operation.

2 Procedures for service initialization between a G3 facsimile equipment and an FPAD

2.1 *Exchange of control information between a G3 facsimile equipment and an FPAD*

In order for a G3 facsimile equipment to exchange an FPAD command signal (see § 3.1.2), an ancillary signalling method is needed between a G3 facsimile equipment and an FPAD.

2.1.1 *Use of ancillary signalling methods*

The FPAD may accept control information through the following ways:

– dual-tone multi-frequency (DTMF) codes generated by the G3 facsimile equipment or by an external device;

– association of other equipment (e.g. videotex) with the G3 facsimile equipment;

– pre-message and/or post-message processing, perhaps, using the V.21 modulation scheme;

– optical character recognition;

– optical mark recognition, or

– other methods.

The selection of one or more ancillary signalling methods is left as a national matter.

2.1.2 *Ancillary signalling method 1: dual-tone multi-frequency (DTMF) codes*

In view of the availability of DTMF generators already associated with existing G3 facsimile equipment, ancillary signalling method 1: DTMF codes are provided.

The G3 facsimile or associated equipment shall generate dual-tone multi-frequency (DTMF) codes [0 to 9, star (*) and square (#)] described in Recommendations Q.23 and V.19. The FPAD shall expect to receive DTMF codes. This code format applies to the procedures described in § 3.

2.2 *Procedures for initialization*

The references to states in the following procedures correspond to the state diagram, see Figures C-1/X.38 to C-8/X.38.

2.2.1 *Disconnected (state 0)*

2.2.1.1 *At a local FPAD/G3FE interface*

Prior to establishment of the access information path, the G3 facsimile equipment/DCE interface is in the disconnected state.

After the access information path has been established, the G3 facsimile equipment/DCE interface enters:

a) the active link state (§ 2.2.2), when FPAD parameter 1 is not set to 0 (see Figure C-2/X.38), or

b) the FPAD waiting state (§ 3.2.1.1) directly, when FPAD parameter 1 is set to 0 (see Figure C-3/X.38).

Note 1 – In some networks the disconnected state will lead directly to the connection-in-progress state (§ 3.2.1.4) using the one-stage dialling method (see Figure C-4/X.38).

Note 2 – FPAD parameter is defined in § 3.1.1.

2.2.1.2 *At a remote FPAD/G3FE interface*

Prior to reception of an incoming call, the interface is in the disconnected state.

Upon receipt of an incoming call, the interface enters the waiting for ring-back tone state (§ 3.2.2.1) (see Figure C-7/X.38).

2.2.2 *Active link (state 1)*

On entering the active link state, the FPAD transmits an FPAD identification FPAD service signal, when FPAD parameter 1 is not set to 0.

After transmission of an FPAD identification FPAD service signal, the G3 facsimile equipment/DCE interface enters the FPAD waiting state (§ 3.2.1.1).

3 Procedures for the exchange of control information between a G3 facsimile equipment and an FPAD

3.1 *General*

3.1.1 *FPAD parameters*

The operation of the FPAD depends on the current values of internal FPAD variables which are known as FPAD parameters. Initially FPAD parameter values depend on the initial standard profile determined by some previous arrangement with the Administration. The FPAD parameter values for the CCITT standard profile are given in Table 1/X.38.

TABLE 1/X.38

FPAD parameter settings

The parameter references and values relate to Recommendation X.5.

Parameter reference number	Parameter description	Parameter settings for CCITT standard profile
1	Control of FPAD service signals	Set to tonal FPAD service signals (value 1)

Note – The need for additional FPAD parameters is for further study.

3.1.2 *FPAD command signals and FPAD service signals*

FPAD command signals (direction G3 facsimile equipment to FPAD) are provided for:

a) the establishment of a virtual call;

b) the selection of FPAD parameter values;

c) requesting the status of the virtual call, and

d) initializing the FPAD.

FPAD service signals (direction FPAD to G3 facsimile equipment) are provided to:

1) transmit call progress signals to the calling G3 facsimile equipment;

2) acknowledge FPAD command signals, and

3) transmit information regarding the operation of the FPAD to the G3 facsimile equipment.

The formats of FPAD command signals and the standard formats of FPAD service signals are given in § 3.4 below.

The information content of FPAD command signals and FPAD service signals are summarized in Annex A.

3.2 *Procedures for virtual call control*

Figures C-2/X.38 to C-8/X.38 (state diagrams at the interface) show the procedures at the G3 facsimile equipment/DCE interface during call establishment, facsimile procedure and call clearing states.

3.2.1 *Operation at the local G3FE/FPAD interface*

3.2.1.1 *FPAD waiting (state 2)*

On entering the FPAD waiting state, the FPAD indicates its readiness to receive an FPAD command signal by transmitting the prompt FPAD service signal when FPAD parameter 1 is not set to 0.

When the value of FPAD parameter 1 is set to 0, no prompt FPAD service signal is sent.

When the value of FPAD parameter 1 is set to 8, the availability and format of a prompt FPAD service signal is network dependent.

The standard format of the prompt FPAD service signal is given in § 3.4.2.2.

Following the transmission of a prompt FPAD service signal, the G3 facsimile equipment may transmit an FPAD command signal.

The interface shall remain in this state until the first code of an FPAD command is received.

At the start of an FPAD command signal, the interface enters the FPAD command state (§ 3.2.1.3).

3.2.1.2 *Network user identification (NUI)*

When required, for security, billing and/or network management purposes the network user shall transmit a network user identification signal. Some Administrations may identify a calling G3 facsimile equipment by other means such as its originating telephone number. When implemented, the network user identification signal will be defined in the facility request block of a selection FPAD command signal.

The format of the facility request block is defined in § 3.4.1.2.

The information content of the network user identification signal is network dependent.

The example of NUI in a selection FPAD command is shown in § 3.4.1.2.6.

3.2.1.3 *FPAD command (state 3)*

The G3 facsimile equipment may request the establishment of a virtual call by transmitting a selection FPAD command signal. On receipt of a valid address block (see § 3.4) in selection FPAD command signal, the interface enters the connection-in-progress state (§ 3.2.1.4).

The procedure upon receipt of another FPAD command signal other than a selection FPAD command is defined in § 3.3 below.

The formats of FPAD command signals are given in § 3.4 below.

3.2.1.4 *Connection-in-progress (state 4)*

The connection-in progress state is defined in the following substates.

3.2.1.4.1 *Virtual call-in-progress (substate 4.1)*

Upon entry to the connection-in-progress state, the interface is in the virtual call-in-progress substate and the FPAD will transmit an acknowledgement FPAD service signal when FPAD parameter 1 is not set to 0.

The interface shall remain in this substate until:

– the virtual call is established, or

– the virtual call establishment fails.

In this substate the FPAD will not accept any FPAD command signals. In some networks, however, a G3 facsimile equipment may request in this substate the status of a virtual call by sending a status FPAD command signal. The format of the status FPAD command signal is given in § 3.4 below:

a) If the virtual call establishment fails:

   – the FPAD transmits a clear indication FPAD service signal to the G3 facsimile equipment when FPAD parameter 1 is not set to 0;

   – the interface enters:

      – the FPAD waiting state (§ 3.2.1.1) in case of two-stage dialling, or

      – the disconnected state (§ 2.2.1) in case of one-stage dialling.

b) Upon establishment of a virtual call:

   – the interface enters ring-back substate (§ 3.2.1.4.2).

3.2.1.4.2 *Ring-back (substate 4.2)*

On entering the ring-back substate, the FPAD sends a ring-back FPAD service signal to the G3 facsimile equipment when FPAD parameter 1 is not set to 0.

When FPAD parameter 1 is set to 0, the FPAD will not transmit a ring-back FPAD service signal to a G3 facsimile equipment. Therefore, it is for the user to define the way in which information regarding the completion of the connection is signalled to the G3 facsimile equipment.

The interface shall remain in this substate until one of the following FPAD messages is forwarded from the remote FPAD or DTE:

– a T.30 signal FPAD message (CED);

– a T.30 signal FPAD message [(CSI)-DIS], or

– a T.30 signal FPAD message (ring-back-off).

a) If a T.30 signal FPAD message [CED or (CSI)-DIS] is received from the remote FPAD or DTE:

   – the FPAD transmits a CED signal or (CSI)-DIS command to the G3 facsimile equipment, and

   – the interface enters:

      – the waiting for T.30 signal FPAD message (T.30 command) substate 5.1 (§ 4.1.1.1) in the facsimile procedure state in case of CED;

      – the waiting for G3FE command substate 5.2 (§ 4.1.1.2) in the facsimile procedure state in case of (CSI)-DIS.

b) If a T.30 signal FPAD message (ring-back-off) is received from the remote FPAD or DTE:

   – the FPAD stops transmitting a ring-back FPAD service signal, and

   – the interface enters the connected substate (§ 3.2.1.4.3).

3.2.1.4.3 *Connected (substate 4.3)*

On entering the connected substate, the FPAD stops the ring-back FPAD service signal.

The interface shall remain until one of the following FPAD messages is forwarded from the remote FPAD or DTE:

– a T.30 signal FPAD message (CED), or

– a T.30 signal FPAD message [(CSI)-DIS].

In this substate, the FPAD may receive a command from the G3 facsimile equipment and an ancillary control FPAD message from the remote FPAD or DTE.

a) Upon receipt of a command from the G3 facsimile:

- the FPAD forwards it to the remote FPAD or DTE using an ancillary control FPAD message; the format of an ancillary control FPAD message is given in § 4.4.11 of Recommendation X.39, and
- the FPAD stays in the same substate.

b) Upon receipt of an ancillary control FPAD message from the remote FPAD or DTE:

- the FPAD transmits it to the G3 facsimile equipment, and
- the FPAD stays in the same substate.

c) If a T.30 signal FPAD message [CED or (CSI)-DIS] is received from the remote FPAD or DTE:

- the FPAD transmits a CED signal or (CSI)-DIS command to the G3 facsimile equipment, and
- the interface enters:
  - the waiting for T.30 signal FPAD message (T.30 command) substate 5.1 (§ 4.1.1.1) in the facsimile procedure state in case of CED, or
  - the waiting for G3FE command substate 5.2 (§ 4.1.1.2) in the facsimile procedure state in case of (CSI)-DIS.

3.2.2 *Operation at a remote FPAD/G3FE interface*

3.2.2.1 *Waiting for ring-back tone (state 6)*

Upon reception of an incoming call in the disconnected state (§ 2.2.1), the FPAD enters the waiting for ring-back tone state.

Upon entering this state, the FPAD attempts to establish an AIP towards the G3 facsimile equipment and waits for a ring-back tone from GSTN.

The interface shall remain in this state until:

- a ring-back tone from the GSTN is detected;
- a CED signal or a (CSI)-DIS command is received from the G3 facsimile equipment;
- Tc timer expires; or
- AIP set-up fails.

a) If a ring-back tone is detected or Tc timer expires:

- the FPAD accepts the virtual call from the local FPAD or DTE, and
- the interface enters the ringing state (§ 3.2.2.2).

b) If a CED signal or (CSI)-DIS command is received from the G3 facsimile equipment:

- the FPAD accepts the virtual call from the local FPAD or DTE;
- the FPAD forwards a T.30 signal FPAD message [CED or (CSI)-DIS] to the local FPAD or DTE, and
- the interface enters:
  - the waiting for G3FE command substate 5.2 (§ 4.1.2.1) in the facsimile procedure state in case of CED, or
  - the waiting for T.30 signal FPAD message (T.30 command) substate 5.1 (§ 4.1.2.2) in the facsimile procedure state in case of (CSI).DIS.

c) If an AIP set-up fails:

- the FPAD clears the virtual call, and
- the interface enters the disconnected state (§ 2.2.1).

3.2.2.2 *Ringing (state 7)*

In the ringing state, the FPAD waits for the answering by the G3FE.

The interface shall remain in this state until:

– an off-hook signal from the GSTN is detected;

– a CED signal or (CSI)-DIS command is received from the G3 facsimile equipment, or

– Td timer expires.

a) If an off-hook signal is detected:

– the FPAD forwards a T.30 signal FPAD message (ring-back-off) to the local FPAD or DTE, and

– the interface enters the waiting for CED state (§ 3.2.2.3).

b) If Td timer expires:

– the FPAD clears the virtual call and AIP in accordance with § 3.2.3.4.2, and

– the interface enters the disconnected state (§ 2.2.1).

c) If a CED signal or (CSI)-DIS command is received from the G3 facsimile equipment:

– the FPAD forwards a T.30 signal FPAD message [CED or (CSI)-DIS] to the local FPAD or DTE, and

– the interface enters:

– the waiting for G3FE command substate 5.2 (§ 4.1.2.1) in the facsimile procedure state in case of CED, or

– the waiting for T.30 signal FPAD message (T.30 command) substate 5.1 (§ 4.1.2.2) in the facsimile procedure state in case of (CSI)-DIS.

3.2.2.3 *Waiting for CED (state 8)*

In this state, the FPAD waits for a CED signal. The interface shall remain in this state until a CED signal or (CSI)-DIS command is received.

a) If a CED signal or (CSI).DIS command is received from the G3 facsimile equipment:

– the FPAD forwards a T.30 signal FPAD message [CED or (CSI)-DIS] to the local FPAD or DTE, and

– the interface enters:

– the waiting for G3FE command substate 5.2 (§ 4.1.2.1) in the facsimile procedure state in case of CED, or

– the waiting for T.30 signal FPAD message (T.30 command) substate 5.1 (§ 4.1.2.2) in the facsimile procedure state in case of (CSI)-DIS.

b) If Td timer expires:

– the FPAD clears the virtual call and AIP in accordance with § 3.2.3.4.2, and

– the interface enters the disconnected state (§ 2.2.1).

3.2.3 *General*

3.2.3.1 *Unsuccessful calls*

If a call is unsuccessful for any reason, the FPAD will indicate the reason to the G3 facsimile equipment by means of a clear indication FPAD service signal, when FPAD parameter 1 is not set to 0.

When FPAD parameter 1 is set to 0, a clear indication FPAD service signal is not transmitted.

After transmission of the clear indication FPAD service signal the FPAD enters the FPAD waiting state (§ 3.2.1.1).

3.2.3.2 *Fault conditions*

3.2.3.2.1 *Failure to receive an FPAD command signal*

If the first code of an FPAD command signal is not received with Ta seconds of the interface entering the FPAD waiting state, the FPAD will perform FPAD clearing in accordance with § 3.2.3.4.2 below. The value of Ta is given in Table B-1/X.38.

This restriction does not apply to a G3 facsimile equipment which is directly connected to the FPAD.

If following the first code of an FPAD command signal an FPAD command signal delimiter is not received within Tb seconds, the FPAD will transmit an error FPAD service signal, when FPAD parameter 1 is not set to 0, indicating that an error has occurred (see § 3.4.2.4 below) and the interface will return to the FPAD waiting state (§ 3.2.1.1). The value of Tb is given in Table B-1/X.38.

If the FPAD receives an unrecognized FPAD command signal, the FPAD transmits an error FPAD service signal, when FPAD parameter 1 is not set to 0, indicating that an error has occurred and the interface returns the FPAD waiting state (§ 3.2.1.1).

The operation of the FPAD when FPAD parameter 1 is set to 0 is for further study.

3.2.3.2.2 *Failure to establish a virtual call*

If the interface enters the FPAD waiting state (§ 3.2.1.1) more than Na times after setting up the access information path without a virtual call being established, the FPAD disconnects the access information path.

This restriction does not apply to a G3 facsimile equipment which is directly connected to the FPAD.

The value for Na is for further study.

3.2.3.2.3 *Invalid facility request*

If the FPAD receives an invalid facility request code the FPAD will perform FPAD clearing in accordance with § 3.2.3.4.2.

3.2.3.3 *Failure of the access information path*

If the access information path is disconnected for any reason, the virtual call attempt or virtual call will be cleared by the FPAD and the interface enters the disconnected state (§ 2.2.1).

3.2.3.4 *Call clearing*

3.2.3.4.1 *Clearing by the G3 facsimile equipment*

G3 facsimile equipment clearing shall be indicated by:

a) transmitting a DCN(Disconnect) command; DCN command is defined in Recommendation T.30. The G3 facsimile equipment will disconnect the access information path, or

b) disconnecting the access information path.

The interface enters the disconnected state (§ 2.2.1).

3.2.3.4.2 *FPAD clearing*

FPAD clearing shall be indicated by:

a) transmitting a DCN command. DCN command is defined in Recommendation T.30. FPAD disconnects the access information path, or

b) disconnecting the access information path.

The interface enters the disconnected state (§ 2.2.1).

3.3 *Procedure for FPAD commands*

3.3.1 *Procedure for setting and changing the values of FPAD parameters*

A G3 facsimile equipment may change the values of one or several FPAD parameters by sending one or more set FPAD command signals, including the parameter reference(s) and the value(s). The format of the set FPAD command signal is defined in § 3.4.1.3.

3.3.2 *Procedure for initializing*

The FPAD can be initialized to reset all FPAD parameters to their standard values, either by using the set FPAD command signal with no parameter reference or value specified. The FPAD may also be explicitly initialized with the initialized FPAD command signal.

3.3.3 *Procedure for selecting address type*

A G3 facsimile equipment may select the type of address which is used in the address block in selection FPAD command. When this command is not used, the type of address is based on Recommendation E.164.

3.3.4 *Procedures for reading the values of one or several FPAD parameters*

The need for this procedure is for further study.

3.3.5 *Procedure for enquiring a virtual call status*

A G3 facsimile equipment may enquire the status of a virtual call by using a status FPAD command signal.

3.4 *Formats of FPAD command signals and FPAD service signals*

3.4.1 *Formats of FPAD command signals*

The FPAD will recognize dual-tone multi-frequency (DTMF) signals for the digits 0 to 9 as well as the star (*) and the square (#), as defined in Recommendations Q.23 and V.19. The star (*) code will be recognized as the command or facility prefix and separator. The square (#) code will be recognized as the FPAD command signal delimiter.

The FPAD may optionally also determine the end of a command by a inter-digit time-out (expiration of Te timer). The duration of Te timer is network-dependent.

The command signals are summarized in Table A-1/X.38

3.4.1.1 *Editing functions in the FPAD*

A sequence of three consecutive stars (***) and a command delimiter will cause a preceding DTMF sequence back to the previous command delimiter and a succeeding DTMF sequence up to the delimiter to be ignored. For example, if the DTMF sequence *123***4# is input, all of the digits 1, 2, 3 and 4 will be ignored.

3.4.1.2 *Format of the selection FPAD command signal*

A selection FPAD command signal shall, in the following order, consist of a facility request block, or an address block, or both.

Each facility request in the facility request block shall begin with the prefix character star (*). The facilities that may be specified are among those defined in Recommendation X.2 or specific to the FPAD. The DTMF coding uses two digits to indicate the letter of the alphabet used for the facility in Table 4/X.28.

The facilities defined for the FPAD are shown in Table A-4/X.38.

The facility field is terminated either by two star characters (**) or by the command delimiter (#).

3.4.1.2.1 *Format of the NUI selection facility request signal*

The format of the facility is the DTMF sequence star-one-four (*14), corresponding to the position of the letter N in the alphabet. The digits following this code indicate the network user Identification.

The need for and format of a further abbreviated signal for this facility is for further study.

3.4.1.2.2 *Format of the packet size selection facility request signal*

The format of the facility is the DTMF sequence star-one-six (*16), corresponding to the position of the letter P in the alphabet.

The digits following this code to indicate the packet size are for further study.

3.4.1.2.3 *Format of the reverse charging facility request signal*

The format of the facility is the DTMF sequence star-one-eight (*18), corresponding to the position of the letter R in the alphabet.

3.4.1.2.4 *Formats of the Closed User Group signals*

The format of the facility is the DTMF sequence star-zero-seven (*07), corresponding to the position of the letter G in the alphabet. The digits following this code indicate the Closed User Group index. The need for a facility with the format DTMF sequence star-one-five (*15), corresponding to the letter O in the alphabet to signal Closed User Group with outgoing access, is for further study.

3.4.1.2.5 *Format for image conversion facility request signal*

The format of the facility is the DTMF sequence star-zero-nine (*09), corresponding to the position of the letter I in the alphabet.

3.4.1.2.6 *Example*

In case where NUI = 53839, packet size = 1024, reverse charge = requested, CUG = 38, address = 123456, *1453839*161024*18*0738**123456# is a selection FPAD command signal.

3.4.1.3 *Standard format of set FPAD command signal*

The format of the command is the DTMF sequence star-five (*5).

The following digit indicates the X.5 parameter reference number. The next digits indicate the parameter value.

The need in future for additional digits to designate the parameter reference number, if more than 9 parameters should be defined, is for further study. The 9 could possibly be used as an escape digit, or a different command digit could be used.

The possibility of signalling more than one parameter reference number and value as a sequence of digit pairs is for further study.

3.4.1.4 *Standard format of status FPAD command signal*

The format of the command is the DTMF sequence star-four (*4).

3.4.1.5 *Standard format of initialize FPAD command signal*

The format of the command is the DTMF sequence star-three (*3).

3.4.1.6 *Standard format of select address type FPAD command signal*

The format of the command is the DTMF sequence star-six (*6).

The following digit indicates the address type number:

1: X.121 address.

3.4.2 *Standard formats of FPAD service signals*

When the value of FPAD parameter 1 is set to 0, no FPAD service signals are sent.

When the value of FPAD parameter 1 is set to 1, 2 or 3, FPAD service signals will be sent in a standard format as defined in § 3.4.2.

When the value of FPAD parameter 1 is set to 8, the availability and format of FPAD service signals is network dependent.

The standard formats of FPAD service signals are shown in Table A-2/X.38.

1) When FPAD parameter 1 is set to 1, tonal signals are sent using tones as defined in Recommendations E.180 and E.182.

2) When FPAD parameter 1 is set to 3, dual-tone multi-frequency (DTMF) signals are sent using tones as defined in Recommendations Q.23 and V.19.

3) When FPAD parameter 1 is set to 2, oral signals are sent.

The tone frequency and period of tone and silence for each tone is defined with a recommended value for new applications. However, a range of frequencies and periods is also permitted by Recommendation E.180/E.182. Unless there is a need for consistency with existing national tones, it is recommended that the following values be used:

a) *Dial tone:* A continuous tone with a single frequency of 425 Hz.

b) *Special dial tone:* A dial tone with three interruptions of 150 msec of silence, each following 150 msec of tone at the start of the signal.

c) *Positive acknowledgement tone:* Two bursts of 150 msec of tone at a frequency of 425 Hz, each followed by 150 msec of silence (not repeated periodically).

d) *Ringing tone:* A slow period tone with alternating tone periods of 0.67 to 1.5 seconds at a frequency of 425 Hz, and silent periods of 3 to 5 seconds.

e) *Busy tone:* A quick period tone with equal tone and silent periods at a frequency of 425 Hz. The period of the tone and silence is from 300 to 1100 msec.

f) *Congestion tone:* Same as busy tone, but with a faster period, within the range specified above.

g) *Special information tone:* Three consecutive tones of frequency 950, 1 400 and 1 800 Hz. Each tone period is 330 msec, with 30 msec of silence after each tone and 1000 msec of silence after the third tone (not repeated periodically).

Note – Special dial tone and positive acknowledgement Tone are not fully specified in Recommendation E.180/E.182.

3.4.2.1 *Standard format of FPAD identification FPAD service signal*

1) When FPAD parameter 1 is set to 1, no tonal signal will be sent.

2) When FPAD parameter 1 is set to 2, the format of the oral signal is network dependent.

3) When FPAD parameter 1 is set to 3, the DTMF signal "##" will be sent.

3.4.2.2 *Standard format of the prompt FPAD service signal*

1) When FPAD parameter 1 is set to 1, the tonal signal “special dial tone” will be sent.

2) When FPAD parameter 1 is set to 2, the oral signal “command please” will be sent.

3) When FPAD parameter 1 is set to 3, the DTMF signal “33” will be sent.

3.4.2.3 *Standard format of the acknowledgement FPAD service signal*

1) When FPAD parameter 1 is set to 1, the tonal signal “positive acknowledgement tone” will be sent.

2) When FPAD parameter 1 is set to 2, the oral signal “accepted” will be sent.

3) When FPAD parameter 1 is set to 3, the DTMF signal “50” will be sent.

3.4.2.4 *Standard format of the error FPAD service signal*

1) When FPAD parameter 1 is set to 1, the tonal signal "special information tone" will be sent.

2) When FPAD parameter 1 is set to 2, the oral signal "error" will be sent.

3) When FPAD parameter 1 is set to 3, the DTMF signal "99" will be sent.

3.4.2.5 *Standard format of the connection in progress FPAD service signal*

1) When FPAD parameter 1 is set to 1, the tonal signal "positive acknowledgement tone" will be sent.

2) When FPAD parameter 1 is set to 2, the oral signal "in progress" will be sent.

3) When FPAD parameter 1 is set to 3, the DTMF signal "55" will be sent.

3.4.2.6 *Standard format of the ring-back FPAD service signal*

1) When FPAD parameter 1 is set to 1, the tonal signal "Ringing tone" will be sent.

2) When FPAD parameter 1 is set to 2, the oral signal "Ringing" will be sent.

3) When FPAD parameter 1 is set to 3, the DTMF signal "00" will be sent.

3.4.2.7 *Standard format of the clear indication FPAD service signal*

1) When FPAD parameter 1 is set to 1, the tonal signal "busy tone", "congestion tone" or "special information tone" will be sent in accordance with Table A-3/X.38.

2) When FPAD parameter 1 is set to 2, the oral signal will be sent in accordance with Table A-3/X.38.

3) When FPAD parameter 1 is set to 3, the DTMF signal will be sent in accordance with Table A-3/X.38.

4 Procedures for the exchange of facsimile image data between a G3 facsimile equipment and an FPAD

The procedures described apply during the facsimile procedure state of the interface to a G3 facsimile equipment.

Implementors should keep in mind the limited amount of flow control available to G3 facsimile machines operating in accordance with the T-Series of Recommendations when determining internal buffer sizes in the FPAD. Further, that overrun due to window closures/congestion on the packet network is forseeable, necessitating buffering within the FPAD environment.

4.1 *Facsimile procedure (state 5)*

In this state, an "emitting FPAD" and a "receiving FPAD" are used as defined below:

1) An FPAD having emitted a CED signal (called station identification) and/or a (CSI)-DIS command to a G3 facsimile equipment is called an "emitting FPAD"; it keeps this designation until changed during the facsimile procedure described hereafter.

2) An FPAD having received a CED signal (called station identification) and/or a (CSI)-DIS command from the G3 facsimile equipment is called a "receiving FPAD"; it keeps this designation until changed during the facsimile procedure described hereafter.

Note – These designations are not relevant to a remote FPAD or a local FPAD.

The interface at an emitting FPAD and a receiving FPAD leaves the facsimile procedure state in accordance with § 4.1.3.

4.1.1 *Substates at an emitting FPAD/G3FE interface*

After an emitting FPAD transmits a CED signal or (CSI)-DIS command to a G3 facsimile equipment, the interface enters:

– the waiting for T.30 signal FPAD message (T.30 command) substate 5.1 in the facsimile procedure state in case CED, or

– the waiting for G3FE command substate 5.2 in the facsimile procedure state in case (CSI)-DIS.

4.1.1.1 *Waiting for T.30 signal FPAD message (T.30 command) (substate 5.1)*

In this substate, the emitting FPAD is waiting for a T.30 signal FPAD message [(CSI)-DIS] from the receiving FPAD or DTE and the procedure should be as follows:

– If a T.30 signal FPAD message [(CSI)-DIS] is received from the receiving FPAD or DTE:
  – the values in the DIS command may be changed in accordance with § 4.2;
  – a (CSI)-DIS command is transmitted to the G3 facsimile equipment, and
  – the interface enters the waiting for G3FE command substate (§ 4.1.1.2).

4.1.1.2 *Waiting for G3FE command (substate 5.2)*

In this substate, an emitting FPAD is waiting for a command from the G3 facsimile equipment or for a response to the (CSI)-DIS command just transmitted to the G3 facsimile equipment and the procedure should be as follows:

a) If a frame with error FCS is received from the G3 facsimile equipment:
  – a CRP response should be transmitted to the G3 facsimile equipment, and
  – the interface stays in the same substate.

  A CRP response is defined in Recommendation T.30.

b) If the same command is received while a response has been previously sent to the emitting G3FE machine, then:
  – the response is sent again by the emitting FPAD to the emitting G3FE machine;
  – the command is not forwarded;
  – the interface stays in the same substate.

  (See the corresponding behaviour in Figure I-9/X.38.)

c) If a (TSI)-DCS command is received from the G3 facsimile equipment:
  – a T.30 signal FPAD message [(TSI)-DCS] is forwarded to the receiving FPAD or DTE;
  – the following TCF is checked, and
  – the interface enters the waiting for T.30 signal FPAD message (T.30 response) substate (§ 4.1.1.3).

d) If a (CIG)-DTC or (CSI)-DIS command is received from the G3 facsimile equipment:
  – the values in the DTC or DIS command may be changed in accordance with § 4.2;
  – a T.30 signal FPAD message [(CIG)-DTC or (CSI)-DIS] is forwarded to the receiving FPAD or DTE, and
  – the FPAD is reassigned as a “receiving FPAD” and the interface enters the waiting for T.30 signal FPAD message (T.30 command) substate 5.1 (§ 4.1.2.2) of the receiving FPAD.

e) If a command other than the above with valid FCS is received from the G3 facsimile equipment:
  – the corresponding T.30 signal FPAD message (T.30 command) is forwarded to the receiving FPAD or DTE, and
  – the interface enters the waiting for T.30 signal FPAD message (T.30 response) substate (§ 4.1.1.3).

f) If facsimile image data is received from the G3 facsimile equipment:
  – the interface enters the forwarding user data substate (§ 4.1.1.4).

g) If a T.30 signal FPAD message [(CSI)-DIS] is received from the receiving FPAD or DTE;
  – the interface enters the waiting for T.30 signal FPAD message (T.30 command) substate 5.1 and proceed as described in that state when a T.30 signal FPAD message [(CSI)-DIS] is received.

Note – This case may occur if the emitting G3 facsimile equipment does not retransmit the previous page even if a RTN response was returned after having transmitted an EOM command.

4.1.1.3 *Waiting for T.30 signal FPAD message (T.30 response) (substate 5.3)*

In this substate, an emitting FPAD is waiting for a T.30 signal FPAD message (T.30 response) from the receiving FPAD or DTE and the procedure should be as follows:

a) If the same command is received from the G3 facsimile equipment:

– the command is ignored, and

– the interface stays in the same substate.

b) If the same command is received from the G3 facsimile equipment with different FPAD parameter values, in order to avoid possible conflict resulting from possible collision:

– a T.30 signal FPAD message (DCN) is forwarded to the receiving FPAD or DTE;

– the AIP and the virtual call is cleared in accordance with § 3.2.3.4.2, and

– the interface leaves the facsimile procedure state (§ 4.1) as specified in § 4.1.3.

c) If a different command is received from the G3 facsimile equipment:

– a T.30 signal FPAD message (DCN) is forwarded to the receiving FPAD or DTE;

– the AIP and the virtual call are cleared in accordance with § 3.2.3.4.2, and

– the interface leaves the facsimile procedure state (§ 4.1) as specified in § 4.1.3.

d) If a frame with error FCS is received from the G3 facsimile equipment:

– the interface stays in the same substate.

e) If a T.30 signal FPAD message (MCF or RTP) is received from the receiving FPAD or DTE after having forwarded a T.30 signal FPAD message (EOM), or if a T.30 signal FPAD message (MCF) is received from the receiving FPAD or DTE after having forwarded a T.30 FPAD message (PPS-EOM), or if a T.30 signal FPAD message (ERR) is received from the receiving FPAD or DTE after having forwarded a T.30 FPAD message (EOR-EOM):

– a corresponding T.30 signal is transmitted to the G3 facsimile equipment, and

– the interface enters the waiting for T.30 signal FPAD message (T.30 command) substate 5.1 (§ 4.1.1.1).

f) If a T.30 signal FPAD message (FTT or CFR) is received from the receiving FPAD or DTE:

– an appropriate response is transmitted to the G3 facsimile equipment in accordance with § 4.5, and

– the interface enters the waiting for G3FE command substate (§ 4.1.1.2).

g) If a T.30 signal FPAD message (T.30 response other than the above) is received from the receiving FPAD or DTE:

– a corresponding response is transmitted to the G3 facsimile equipment, and

– the interface enters the waiting for G3FE command substate (§ 4.1.1.2).

4.1.1.4 *Forwarding user data (substate 5.4)*

In this substate, the facsimile image data is received from the G3 facsimile equipment and the procedure is as follows:

a) While facsimile image data is being received from the G3 facsimile equipment:

– data packets are forwarded to the receiving FPAD or DTE in accordance with § 4.6, and

– the interface stays in the same substate until an RTC is received from the G3 facsimile equipment in case of non-ECM transmission, or

– the interface stays in the same substate until at least, one of three consecutive RCPs are received from the G3 facsimile equipment in case of ECM transmission.

Note – ECM is optionally supported by FPAD. See § 4.2.

b) If an RTC is received from the G3 facsimile equipment in case of non-ECM transmission:

– the last data packet is forwarded to the receiving FPAD or DTE in accordance with § 4.8, and

– the interface enters the waiting for G3FE command substate (§ 4.1.1.2).

RTC is defined in Recommendation T.4.

c) If at least one of three consecutive RCP frames are received from the G3 facsimile equipment in case of ECM transmission:

– the last data packet is forwarded to the remote FPAD or DTE in accordance with § 4.8, and

– the interface enters the waiting for G3FE command substate (§ 4.1.1.2).

RCP frame is defined in Recommendation T.4.

4.1.2 *Substates at a receiving FPAD/G3FE interface*

After a receiving FPAD receives a CED signal or (CSI)-DIS command, the interface enters:

– the waiting for G3FE command substate 5.2 (§ 4.1.2.1) in the facsimile procedure state in case of CED, or

– the waiting for T.30 signal FPAD message (T.30 command) substate 5.1 (§ 4.1.2.2) in the facsimile procedure state in case of (CSI)-DIS.

4.1.2.1 *Waiting for G3FE command (substate 5.2)*

In this substate, a receiving FPAD is waiting for (CSI)-DIS from the G3 facsimile equipment and the procedure should be as follows:

a) If a frame with error FCS is received from the G3 facsimile equipment:

– a CRP response should be transmitted to the G3 facsimile equipment, and

– the interface stays in the same substate.

CRP response is defined in Recommendation T.30.

b) If a (CSI)-DIS command is received from the G3 facsimile equipment:

– the values in the DIS command may be changed in accordance with § 4.2;

– a T.30 signal FPAD message [(CSI)-DIS] is forwarded to the emitting FPAD or DTE, and

– the interface enters waiting for T.30 signal FPAD message (T.30 command) state (§ 4.1.2.2).

4.1.2.2 *Waiting for T.30 signal FPAD message (T.30 command) (substate 5.1)*

In this substate, a receiving FPAD is waiting for a T.30 signal FPAD message (T.30 command) or a user data from the emitting FPAD or DTE; the procedure should be as follows:

Note – The T.30 signal FPAD message (T.30 command) expected carries actually a T.30 response in case of a (CSI)-DIS just forwarded.

a) If the facsimile message is expected by the receiving G3 facsimile equipment and if no user data is incoming from the emitting FPAD or DTE:

– after T2 - 1 seconds, the training at the message speed chosen by the already received DCS is sent and if no user data is present at its completion:

– for non-error correction mode, fill bits “0” are padded. Fill bits are defined in Recommendation T.4,

– for error correction mode (ECM), flags are padded.

Note – ECM is optionally supported by FPAD. See § 4.2.

(See the corresponding behaviour in Figure I-9/X.38 hereafter.)

b) If a T.30 command is expected by the receiving G3 facsimile equipment and if no T.30 signal FPAD message is received within T2 – 1 seconds from the emitting FPAD or DTE:

– flags should be sent for 1 second to reset T2 timer of the receiving G3 facsimile equipment, and

– the interface stays in the same substate.

T2 timer is defined in Recommendation T.30.

c) If a T.30 signal FPAD message [(TSI)-DCS] is received from the emitting FPAD or DTE:

– a (TSI)-DCS and TCF are transmitted to the G3 facsimile equipment, and

– the interface enters the waiting for G3FE response substate (§ 4.1.2.3).

d) If a T.30 signal FPAD message [(CIG)-DTC or (CSI)-DIS] is received from the emitting FPAD or DTE:

– the values in the DTC or DIS command may be changed in accordance with § 4.2;

– a (CIG)-DTC or (CSI)-DIS is transmitted to the G3 facsimile equipment, and

– the FPAD is reassigned as an "emitting FPAD" and the interface enters the waiting for G3FE response substate 5.2 (§ 4.1.1.2) of the "emitting FPAD".

e) If a T.30 signal FPAD message (T.30 command other than the above) is received from the emitting FPAD or DTE:

– a corresponding T.30 command should be transmitted to the G3 facsimile equipment, and

– the interface enters the waiting for G3FE response substate (§ 4.1.2.3).

f) If user data is received from the emitting FPAD or DTE:

– the interface enters the delivering user data substate (§ 4.1.2.4).

g) If the same command is received from the G3 facsimile equipment:

– the command is ignored, and

– the interface stays in the same state.

h) If a (CSI)-DIS is received from the G3 facsimile equipment:

– the interface enters the waiting for G3FE command substate 5.2 (§ 4.1.2.1) and proceed as described in that state when (CIS)-DIS command is received.

Note – This case may occur if the emitting G3 facsimile equipment does not retransmit the previous page even if a RTN response was returned after having transmitted an EOM command.

4.1.2.3 *Waiting for G3FE response (substate 5.5)*

In this substate, a receiving FPAD is waiting for a response from an G3 facsimile equipment and the procedure should be as follows:

a) If no response is received within T4 seconds or a response with error FCS is or a CRP response received from the G3 facsimile equipment:

– the previous command is retransmitted to the G3 facsimile equipment, and

– the interface stays in the same substate.

T4 timer is defined in Recommendation T.30.

b) If an MCF or RTP response is received from a G3 facsimile equipment after having transmitted an EOM command, or if an MCF response is received from a G3 facsimile equipment after having transmitted a PPS-EOM command, or if an ERR response is received from a G3 facsimile equipment after having transmitted an EOR-EOM command:

– a corresponding T.30 FPAD message is forwarded to the emitting FPAD or DTE; and

– the interface enters the waiting for G3FE command substate 5.2 (§ 4.1.2.1).

Note – EOR-EOM and PPS-EOM are used in ECM transmission only and ECM is optionally supported by FPAD. See § 4.2.

c) If a response other than the above with valid FCS is received from the G3 facsimile equipment:

- a corresponding T.30 signal FPAD message is forwarded to the emitting FPAD or DTE, and
- the interface enters the waiting for T.30 signal FPAD message (T.30 command) substate (§ 4.1.2.2).

4.1.2.4 *Delivering user data (substate 5.6)*

In this substate, the user data is delivered to a G3 facsimile equipment and the procedure is as follows:

a) While user data is being received from the emitting FPAD or DTE:

- the facsimile image data is delivered to the G3 facsimile equipment in accordance with § 4.7, and
- the interface stays in the same substate until the last packet is received.

b) If the last packet is received from the emitting FPAD or DTE:

- the interface enters the waiting for T.30 signal FPAD message (T.30 command) substate (§ 4.1.2.2) after the remaining data in the FPAD is delivered to the G3 facsimile equipment.

4.1.3 *Procedures for leaving facsimile procedure state*

4.1.3.1 *Procedures at a local FPAD/G3FE interface*

1) *Virtual call failure*

When a virtual call failure occurs:

- a DCN command is transmitted to the G3 facsimile equipment;
- a cleared FPAD service signal is transmitted to the G3 facsimile equipment, when the FPAD parameter 1 is not set to 0, and
- the interface enters:
  - the FPAD waiting state (§ 3.2.1.1) in case of two-stage-dialling, or
  - the disconnected state (§ 2.2.1) after disconnecting the AIP in case of one-stage-dialling.

2) *Reception of a DCN command*

When a DCN command is received from the G3 facsimile equipment:

- a T.30 signal FPAD message (DCN) is forwarded to the remote FPAD or DTE, and
- the interface enters:
  - the FPAD waiting state (§ 3.2.1.1) in case of two-stage-dialling, or
  - the disconnected state (§ 2.2.1) after an invitation to clear FPAD message is forwarded to the remote FPAD or DTE and the AIP is disconnected in case of one-stage-dialling.

3) *Reception of an invitation to clear FPAD message*

When an invitation to clear FPAD message is received from the remote FPAD or DTE:

- a cleared FPAD service signal is transmitted to the G3 facsimile equipment, when the FPAD parameter 1 is not set to 0, and
- the interface enters:
  - the FPAD waiting state (§ 3.2.1.1) in case of two-stage-dialling;
  - the disconnected state (§ 2.2.1) after disconnecting the AIP in case of one-stage-dialling.

4) *AIP failure*

When an AIP failure occurs:

- an invitation to clear FPAD message is forwarded to the remote FPAD or DTE, and
- the interface enters the disconnected state (§ 2.2.1).

4.1.3.2 *Procedures at a remote FPAD/G3FE*

1) *Virtual call failure interface*

When a virtual call failure occurs:

– a DCN command is transmitted to the G3 facsimile equipment, and

– the interface enters the disconnected state (§ 2.2.1) after disconnecting the AIP.

2) *Reception of a DCN command*

When a DCN command is received from the G3 facsimile equipment:

– a T.30 signal FPAD message (DCN) and an invitation to clear FPAD message are transmitted to the local FPAD or DTE, and

– the interface enters the disconnected (§ 2.2.1) state after disconnecting the AIP.

3) *Reception of an invitation to clear FPAD message*

When an invitation to clear FPAD message is received from the local FPAD or DTE:

– the interface enters the disconnected (§ 2.2.1) state after disconnecting the AIP.

4) *AIP failure*

When an AIP failure occurs:

– an invitation to clear FPAD message is forwarded to the local FPAD or DTE, and

– the interface enters the disconnected state.

4.2 *Receiving capability notification in DIS or DTC command*

When a (CSI)-DIS or (CIG)-DTC command is received at a receiving FPAD, a T.30 signal FPAD message [(CSI)-DIS or (CIG)-DTC] is forwarded to an emitting FPAD or DTE. If the capability notified in the DIS or DTC command is higher than that of the receiving FPAD itself, the FPAD should replace the capability value to the highest capability available in the FPAD before forwarding.

When a T.30 signal FPAD message [(CSI)-DIS or (CIG)-DTC] is received at an emitting FPAD, a (CSI)-DIS or (CIG)-DTC command is transmitted to a G3 facsimile equipment. If the capability notified in the T.30 signal FPAD message [(CSI)-DIS or (CIG)-DTC] is higher than that of the emitting FPAD itself, the FPAD should replace the capability value to the highest capability available in the FPAD before transmitting.

For example, if ECM is not supported by an FPAD, the corresponding bit in DIS will be turned off by the FPAD. Consequently ECM transmission will not follow in the facsimile procedure phase.

Note 1 – DIS may be preceded by CSI (called subscriber identification); CSI is defined in Recommendation T.30.

Note 2 – DTC may be preceded by CIG (calling subscriber identification); CIG is defined in Recommendation T.30.

Note 3 – The impact of non-standard facilities is described in § 4.3.

4.3 *Non-standard facilities*

The impact of sending non-standard facilities is shown in Annex D.

4.4 *Procedure upon receipt of procedure interrupt command or response*

When a command/response or T.30 signal FPAD message (T.30 command/response) which causes the procedure interrupt is received from a G3 facsimile equipment, the procedure of the FPAD should be as defined in Table 2/X.38.

Note – The mandatory functions of FPAD is defined in § 2.4 of Recommendation X.5.

TABLE 2/X.38

Procedure upon receipt of procedure interrupt command or response

Signal received from a G3FE		T.30 signal FPAD message to be forwarded	Signal to be transmitted to a G3FE
Command	PRI-MPS PRI-EOP PRI-EOM EOR-PRI-MPS EOR-PRI-EOP EOR-PRI-EOM PPS-PRI-MPS PPS-PRI-EOP PPS-PRI-EOM	PRI-MPS PRI-EOP PRI-EOM EOR-PRI-MPS EOR-PRI-EOP EOR-PRI-EOM PPS-PRI-MPS PPS-PRI-EOP PPS-PRI-EOM	MPS EOP EOM EOR-MPS EOR-EOP EOR-EOM PPS-MPS PPS-EOP PPS-EOM
Response	PIN PIP	PIN PIP	RTN RTP

PRI-MPS Procedure interrupt MPS
PRI-EOP Procedure interrupt EOP
PRI-EOM Procedure interrupt EOM
EOR-PRI-MPS End of retransmission PRI-MPS
EOR-PRI-EOP End of retransmission PRI-EOP
EOR-PRI-EOM End of retransmission PRI-EOM
PPS-PRI-MPS Partial page signal PRI-MPS
PPS-PRI-EOP Partial page signal PRI-EOP
PPS-PRI-EOM Partial page signal PRI-EOM
PIN Procedure interrupt negative
PIP Procedure interrupt positive
RTN Retrain negative
RTP Retrain positive
MPS Multi-page signal
EOP End of procedure
EOM End of message
EOR-MPS End of retransmission MPS
PPS-MPS Partial page signal MPS

Note 1 – A command or response to/from a G3 facsimile equipment is defined in Recommendation T.30.

Note 2 – A T.30 signal FPAD message is defined in Recommendation X.39.

Note 3 – Commands preceded by EOR or PPS are used in ECM transmission only. ECM is optionally supported by FPAD. See § 4.2.

4.5 *Determination of data signalling rate*

When a CFR (Confirmation to receive) or an FTT (failure to train) is received from a G3 facsimile equipment at a receiving FPAD, a T.30 signal FPAD message (CFR or FTT respectively) should be forwarded to an emitting FPAD.

According to the result of a TCF received from a G3 facsimile equipment and the T.30 signal FPAD message (CFR or FTT) forwarded from a receiving FPAD or DTE, an emitting FPAD transmits FTT or CFR according to Table 3/X.38.

TABLE 3/X.38

Decision table of signalling rate of an emitting FPAD

T.30 signal FPAD message forwarded from FPAD or DTE	TCF signal receive from a G3FE	Signal to be transmitted to G3FE
CFR	Success	CFR
FTT	Success	FTT
CFR	Failure	FTT
FTT	Failure	FTT

4.6 *Facsimile image data from the G3 facsimile equipment received by the FPAD*

Data received from the G3 facsimile equipment shall be packetized and forwarded in accordance with § 4.8 below.

Two transmission procedures are defined depending upon the value of:

– non-T.30 parameter image conversion in the forwarded T.30 FPAD message [(CSI)-DIS or (CIG)-DTC], and

– image conversion facility selected by a user.

1) *Transparency transmission*

The image data is forwarded in the transparency mode if:

– a non-T.30 parameter image conversion is set to 0 in the forwarded T.30 FPAD message [(CSI)-DIS or (CIG)-DTC], and/or

– a user does not select the image conversion facility.

2) *Conversion transmission*

The image data is forwarded in the conversion mode if:

– a non-T.30 parameter image conversion is set to 1 in the forwarded T.30 FPAD message [(CSI)-DIS or (CIG)-DTC], and

– a user selects the image conversion facility.

4.6.1 *Non-error correction mode*

The fill bits in the facsimile image data may be removed. Fill bits are defined in Recommendation T.4.

Note – Fill bits may be inserted by the receiving FPAD. See § 4.7.1.

4.6.1.1 *Transparency transmission*

The facsimile image data is forwarded without any modification.

4.6.1.2 *Conversion transmission*

An error line is replaced by the last correct one received.

The coding of facsimile image data is changed from one dimensional coding or two dimensional coding defined in Recommendation T.4 to modified modified READ defined in Recommendation T.6.

4.6.2 *Error correction mode (ECM)*

All the flags are deleted.

The frames with error FCS, as well as the address, control fields and FCS of a valid FCD frame shall be omitted. RCP frames shall not be transmitted. FCD frame and RCP frame is defined in Recommendation T.4 (see Figure 2/X.38).

Note – ECM is optionally supported by FPAD. See § 4.2.

4.7 *Delivery of user data to the G3 facsimile equipment*

Two transmission procedures are defined as in § 4.6.

4.7.1 *Non-error correction mode*

Fill bits must be inserted where necessary just before each EOL according to the minimum scan line time value specified in DIS command for the purpose of flow control. Fill bits and EOL are defined in Recommendation T.4 and minimum scan line time is defined in Recommendation T.30.

4.7.1.1 *Transparency transmission*

The user data is delivered without any modification.

4.7.1.2 *Conversion transmission*

The coding of facsimile image data is changed from modified modified READ defined in Recommendation T.6 to one dimensional coding or two dimensional coding defined in Recommendation T.4.

4.7.2 *Error correction mode (ECM)*

The address control fields, FCS and flags are added to each FCD frame according to Recommendation T.4.

Three RCP frames are added at the end of each ECM block.

Flags may be inserted between FCD frames for the purpose of flow control. FCD frame, RCP frame, FCS and flag are defined in Recommendation T.4.

Note – ECM is optionally supported by FPAD. See § 4.2

4.8 *Data forwarding conditions*

A packet will be forwarded subject to flow control, whenever enough data has been received from the G3 facsimile equipment to fill a packet after the last packet was forwarded.

4.8.1 *Non-error correction mode*

On receipt of RTC, the current packet will be assembled to be byte aligned utilizing fill bits as defined in T.4 and will be forwarded.

4.8.2 *Error correction mode (ECM)*

On receipt of at least one of three consecutive RCP frames, the current packet will be forwarded. RCP frames are not forwarded.

Note – ECM is optionally supported by FPAD. See § 4.2

4.9 *Procedure for the FPAD to indicate to the G3 facsimile equipment a temporary inability to accept additional information*

Whilst the average throughput of a PSPDN may be sufficient for a particular application, the short term (instantaneous) throughput for a particular user or application can be lower (or even zero) due to other users or applications requiring all the available capacity at that time.

The procedure to enable the FPAD to indicate a temporary inability to receive additional data and to, subsequently, indicate that data will be accepted is for further study.

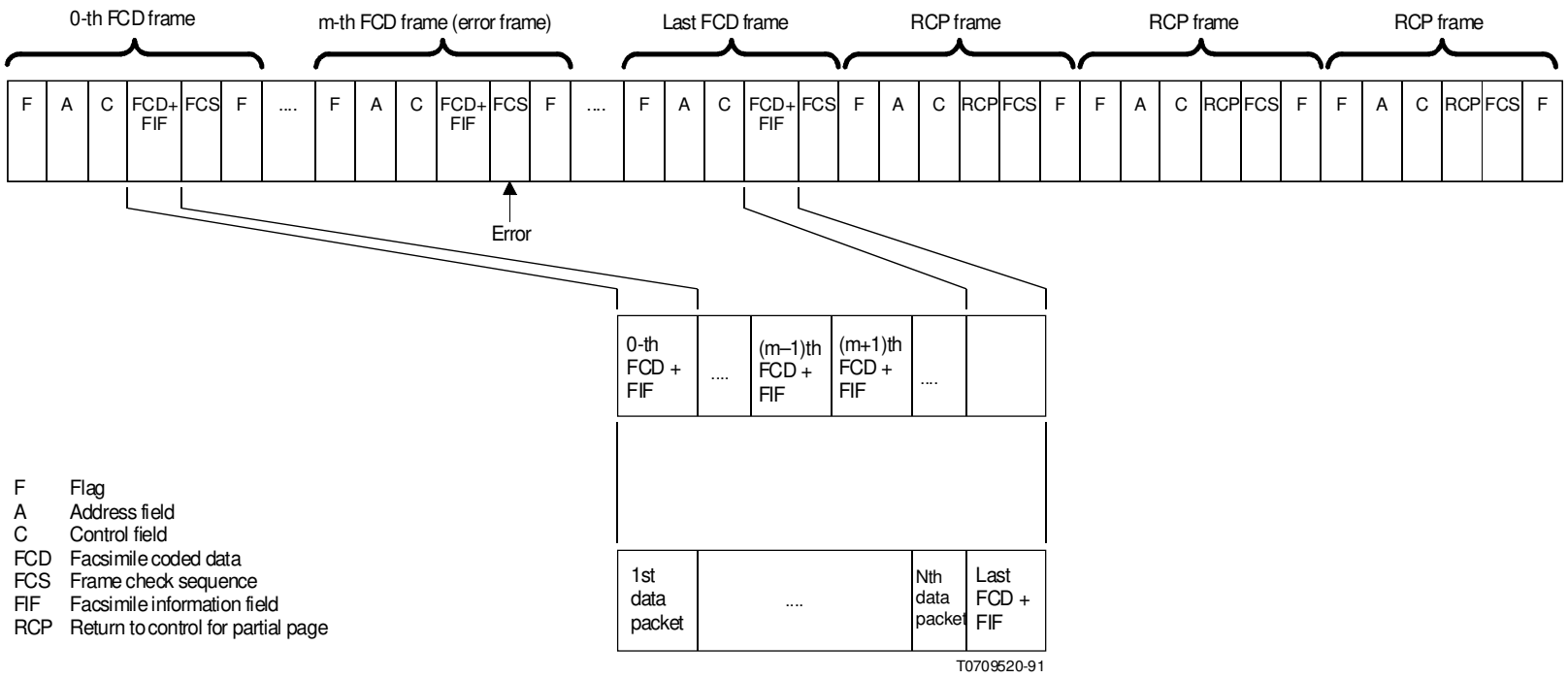


FIGURE 2/X.38

Packetizing process in case of error correction mode (ECM)

ANNEX A

(to Recommendation X.38)

FPAD command signals and FPAD service signals

TABLE A-1/X.38

FPAD command signals

FPAD command signal		Function	FPAD service signal sent in response
Type	Format		
Selection	Note 1	To set up a virtual call	Acknowledgement
Set	*5<value> (Note 2)	To set FPAD parameter values	Acknowledgement
Status	*4	To enquire a virtual call status	Connection-in-progress
Initialize	*3	To initialize the user interface	Acknowledgement
Select	*6<value>	To select the type of address	Acknowledgement

Note 1 – See § 3.4.1.2 and Table A-4/X.38 for details of format.

Note 2 – See § 3.4.1.3 for details of format.

Note 3 – See § 3.4.1.6 for details of format.

Note 4 – *7 through *8 are unassigned for future use.

Note 5 – *9 is reserved for future code expansion.

TABLE A-2/X.38

FPAD service signals

Type of FPAD service signal	Signal number	Standard format of the FPAD service signal			Explanation
		Oral signal	DTMF signal	Tonal signal	
FPAD identification	1	(Network dependent)	# #	None	Identification of an FPAD
Prompt	2	Command please	33	Special dial tone	Request of an FPAD command signal
Acknowledgement	3	Accepted	50	Positive acknowledgement	Acknowledgement of an FPAD command signal
Error	4	Error	99	Special information tone	Indication that an FPAD command signal is in error
Connection-in-progress	5	In progress	55	Positive acknowledgement tone	Response to status FPAD command signal when a call is being established
Clear indication	6	(See Table A-3/X.38)			Indication of clearing
Ring back	7	Ringing	00	Ringing	Indication of connection in progress

TABLE A-3/X.38

Clear indication FPAD service signals

Oral signal (Note 2)	Tonal signal	DTMF signal
Call cleared, number busy	Busy tone	02
Call cleared, temporary network problem	Congestion tone	03
Call cleared, invalid facility requested	Special information tone	04
Call cleared, access to this number is barred	Special information tone	05
Call cleared, network detected local procedure error	Special information tone	06
Call cleared, number not assigned	Special information tone	07
Call cleared, number out of order	Congestion tone	08
Call cleared, remote request	Busy tone	09
Call cleared, by remote device, data may be lost	Congestion tone	01
Call cleared, reverse charging refused	Special information tone	10
Call cleared, incompatible destination	Special information tone	11
Call cleared, ship cannot be contacted	Congestion tone	12
Call cleared, select refused	Special information tone	13
Call cleared, cannot be routed as requested	Congestion tone	14

Note 1 – For details see Recommendation X.96.

Note 2 – Some network may not provide the full signal (i.e. beyond “call cleared”).

TABLE A-4/X.38

Facility request codes

Number code	Letter code (X.28)	Facility
07	G	Closed user group
09	I (non-X.28)	Image conversion
14	N	Network user identification
15	O	CUG with outgoing access
16	P	Packet size
18	R	Reverse charging
00	-	Non-standard facility
To be chosen	To be chosen (non-X.28)	Reserved for conversion from character to facsimile coding scheme

Note – See Recommendation X.2 for the provision of these facilities.

TABLE A-5/X.38

FPAD command signal codes

Numeric code	Command name
3	Initialize
4	Status
5	Set
6	Select address type
7	Unused
8	Unused
9	Reserved for code expansion

ANNEX B

(to Recommendation X.38)

FPAD time-outs

TABLE B-1/X.38

FPAD time-outs

Value	State	Started by	Normally terminated by	Action to be taken when time-out expires	Remarks
Ta = 60 s	2	The FPAD enters the FPAD waiting state	The FPAD has received the first code of FPAD command signal	The FPAD clears AIP in accordance with § 3.2.3.4.2	
Tb > 60 s	3	The FPAD has received the first code of FPAD command signal	The FPAD has received an FPAD command delimiter	The FPAD will transmit an error FPAD service signal (when FPAD parameter 1 is not set to 0) and will return to the FPAD waiting state. Its action is for further study when FPAD parameter 1 is set to 0	(Note 1)
Tc = 60 s	6	The FPAD enters the waiting for ringing state	FPAD has received a CED or (CSI)-DIS	The FPAD will transmit call connect and will enter the ringing state	
Td = 20 s	7	The FPAD enters the ringing state	G3FE has rung on	The FPAD will clear the virtual call and disconnect the access information path	
	8	The FPAD enters the waiting for CED state	The FPAD has received a CED or (CSI)-DIS		
Te (Note 2)		A DTMF digit is received	The next DTMF is entered	The FPAD assumes the end of a command	

Note 1 – The FPAD will permit entry into the FPAD waiting state Na times before disconnecting the access information path. These time-outs are not applicable in the case of leased circuits.

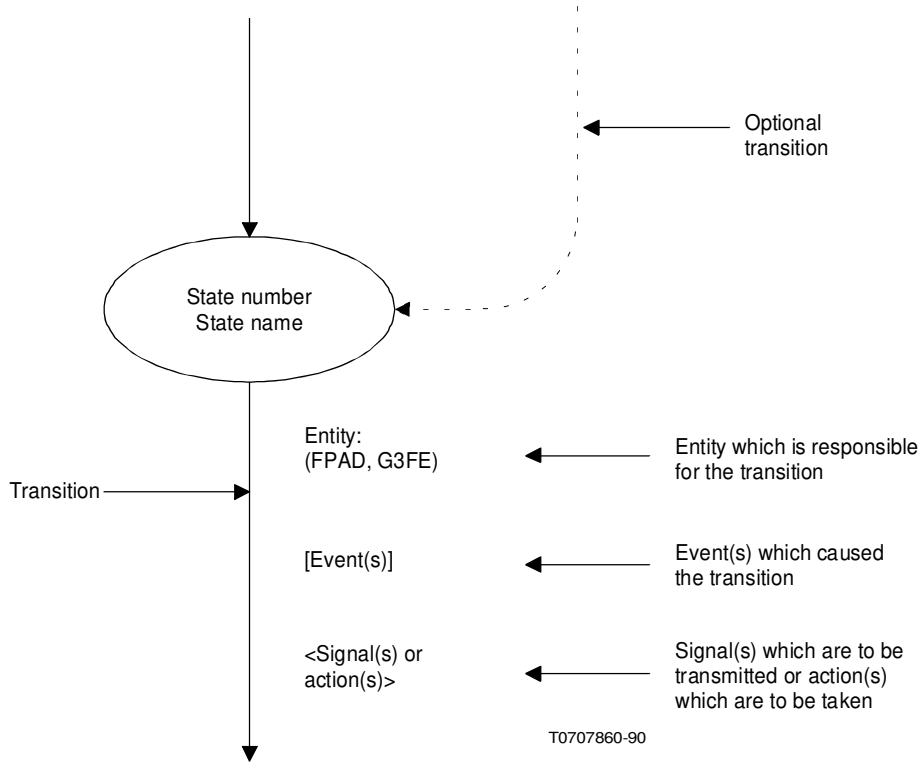
Note 2 – Network dependent.

Note 3 – The tolerance of each timer is for further study.

ANNEX C

(to Recommendation X.38)

State diagrams



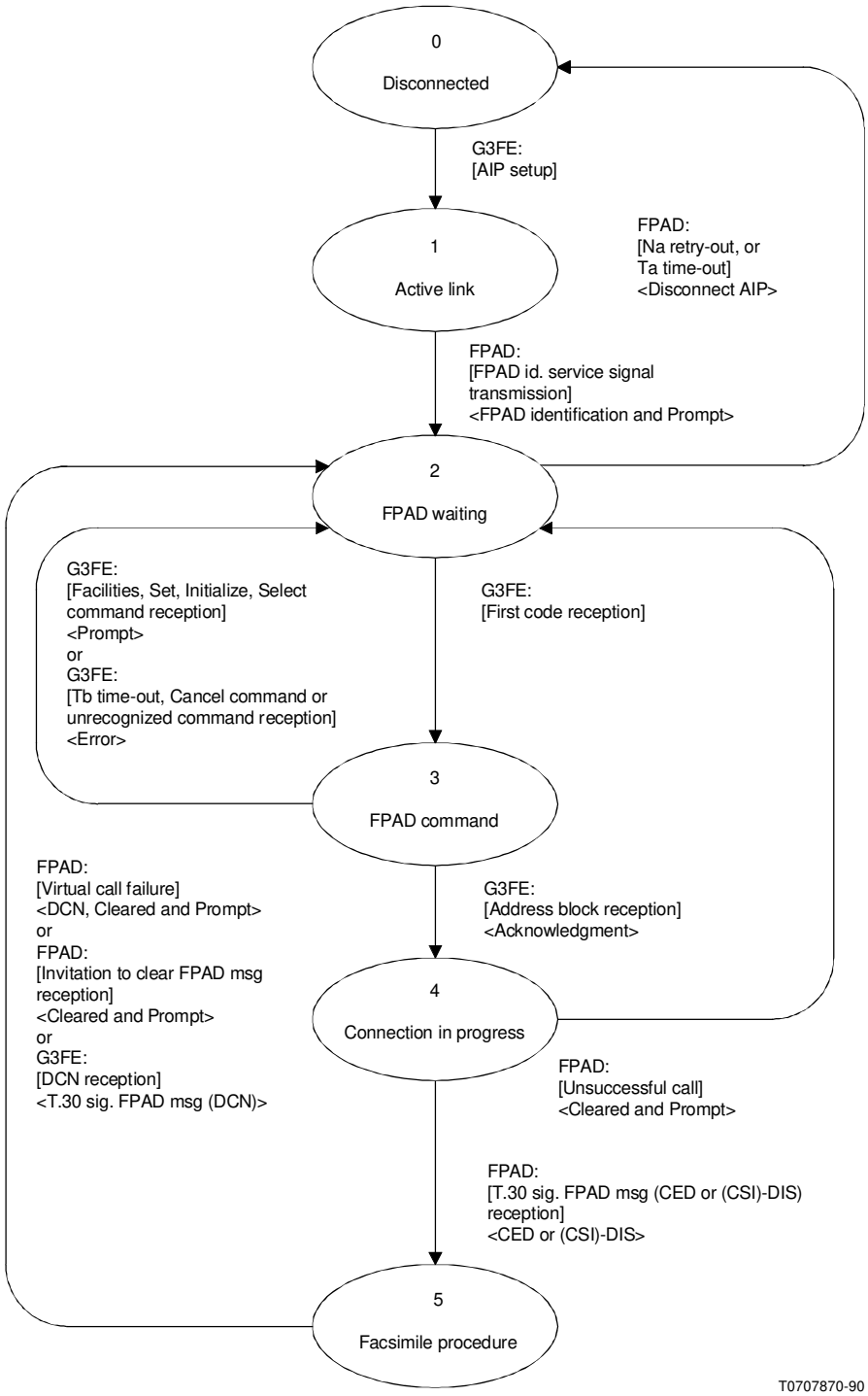
Note 1 – Each state is represented by an ellipse wherein the state number and state name are indicated.

Note 2 – Each transition is represented by a solid arrow; an optional transition is represented by a dotted arrow.

Note 3 – The entity which is responsible for the transition {FPAD or G3FE}, [the event(s)] that caused the transition and <the signal(s) or action(s)> that are to be transmitted or to be taken, are indicated beside the arrow.

FIGURE C-1/X.38

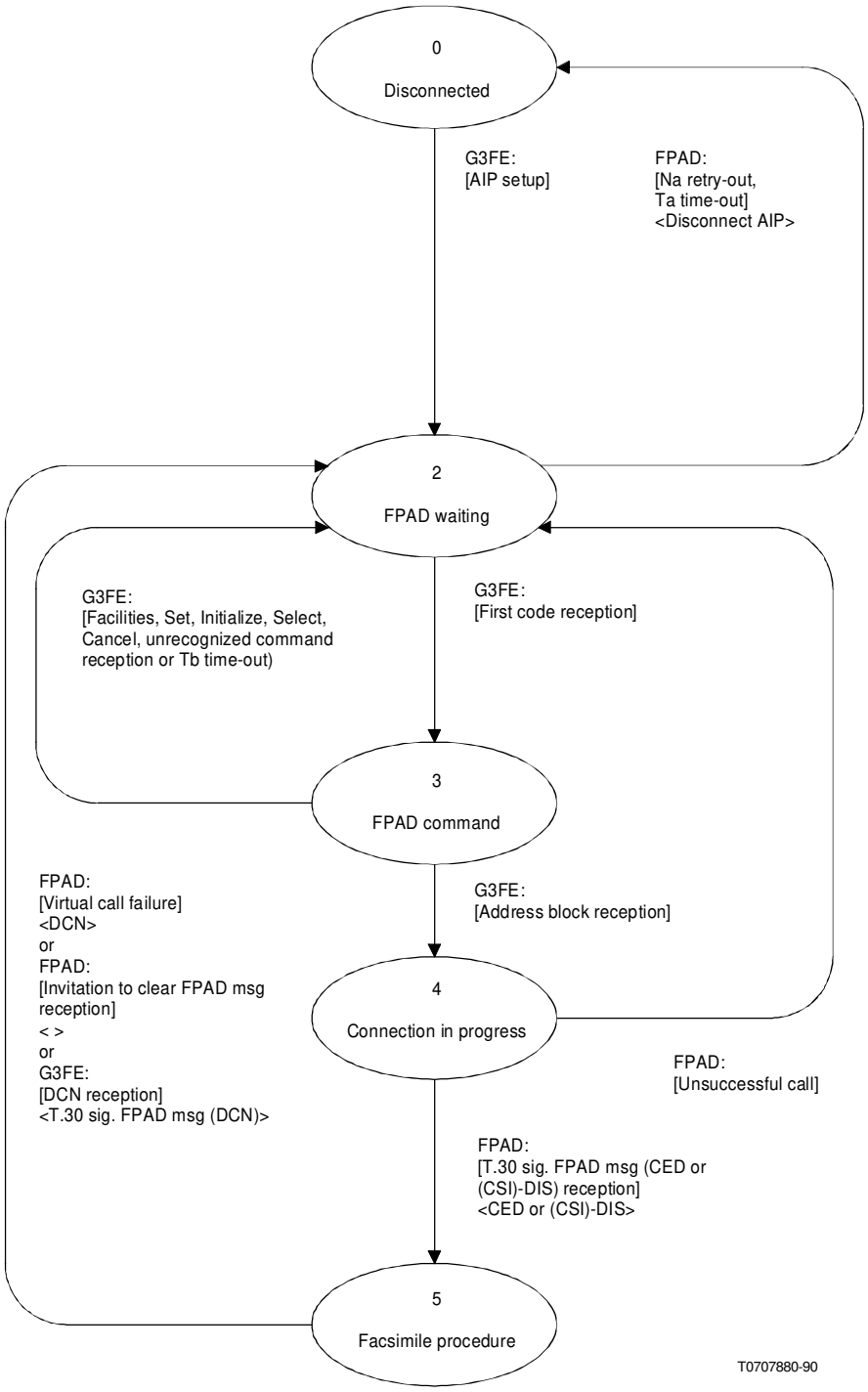
Symbol definitions of the state diagram



Note – In states 1 to 5 if the AIP is disconnected or fails, the interface enters the disconnected state with no FPAD service signal.

FIGURE C-2/X.38

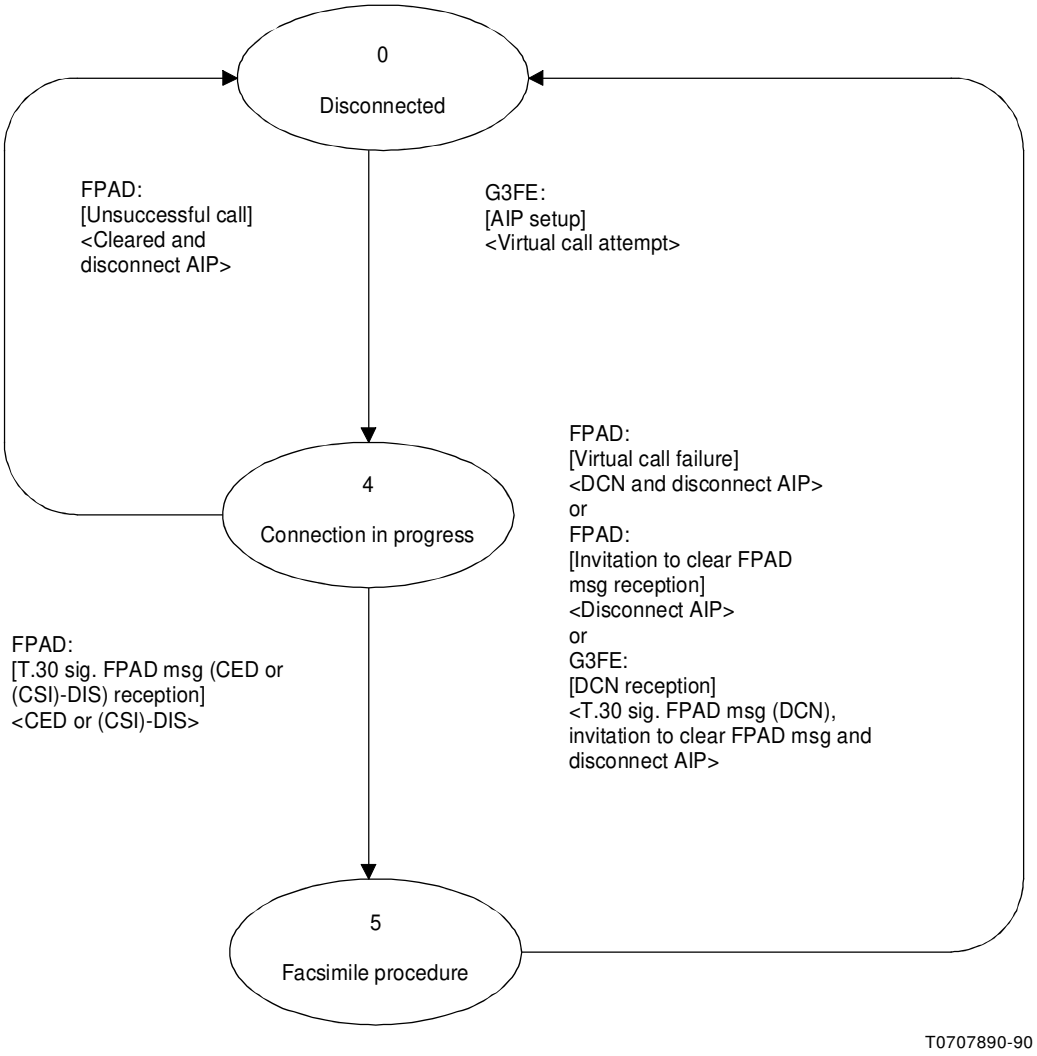
State diagram of call establishment and call clearing using two-stage-dialling at a local FPAD when FPAD parameter 1 is not set to 0



Note – In states 2 to 5 if the AIP is disconnected or fails, the interface will enter the disconnected state.

FIGURE C-3/X.38

State diagram of call establishment and call clearing using two-stage-dialling at a local FPAD when FPAD parameter 1 is set to 0

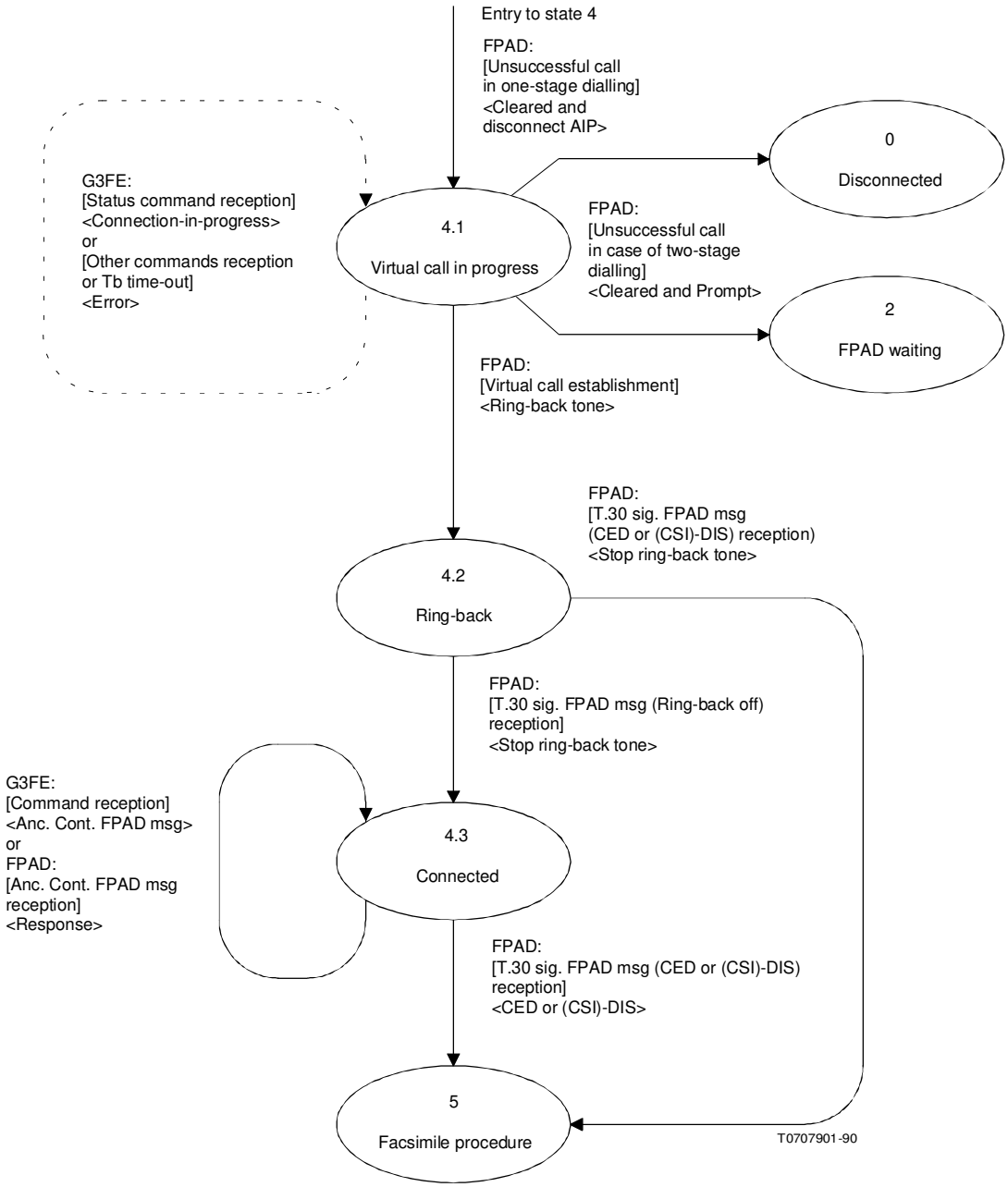


Note 1 – FPAD service signals are sent if FPAD parameter 1 is not set to 0.

Note 2 – In states 4 and 5 if the AIP is disconnected or fails, the interface will enter the disconnected state with no FPAD service signal.

FIGURE C-4/X.38

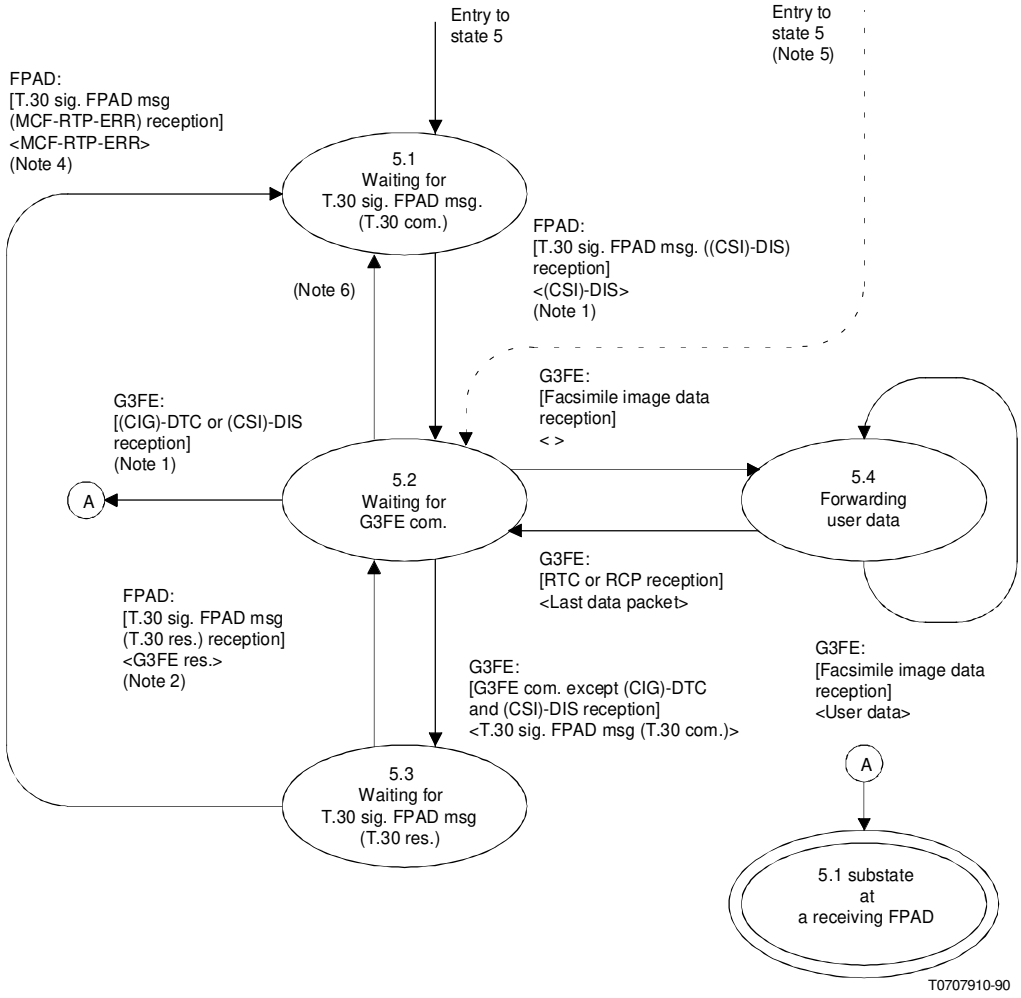
State diagram of call establishment and call clearing using one-stage-dialling at a local FPAD



Note – The condition for leaving state 5 is defined in Figures C-2/X.38 to C-4/X.38.

FIGURE C-5/X.38

Substate diagram in connection-in-progress state (state 4) at a local FPAD



Note 1 – The values in DIS and DTC may be changed in accordance with § 4.2.

Note 2 – If the T.30 signal FPAD message is a T.30 signal FPAD message (CFR or FTT), an appropriate response should be transmitted, as described in § 4.5.

Note 3 – The conditions for leaving state 5 are defined in Figures C-2/X.38 to C-4/X.38.

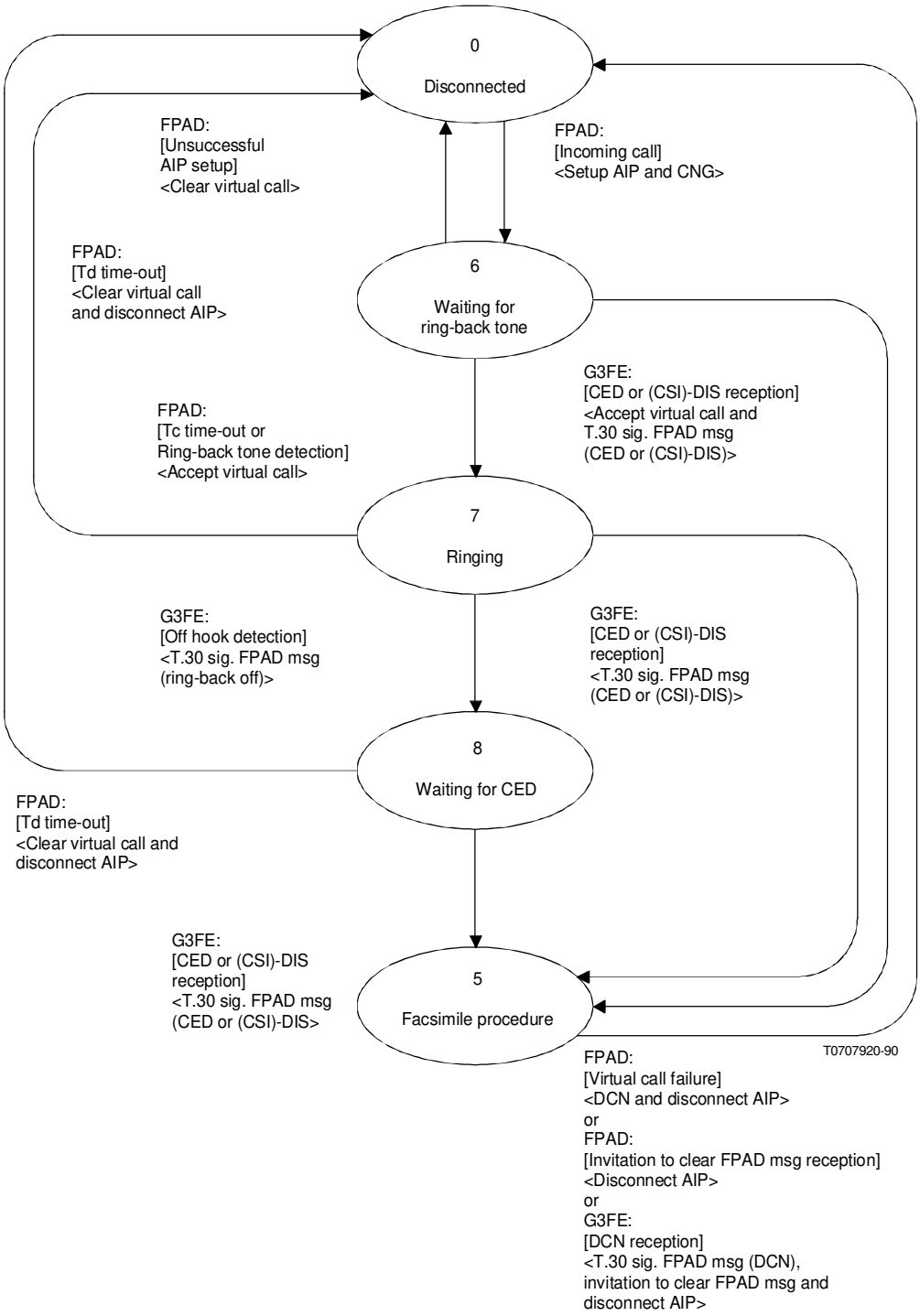
Note 4 – The condition for this transition is described in § 4.1.1.3, e).

Note 5 – If the interface enters the facsimile procedure state upon receipt of T.30 signal FPAD message [(CSI)-DIS], the interface enters substate 5.2.

Note 6 – The condition for this transition is described in § 4.1.1.2, g).

FIGURE C-6/X.38

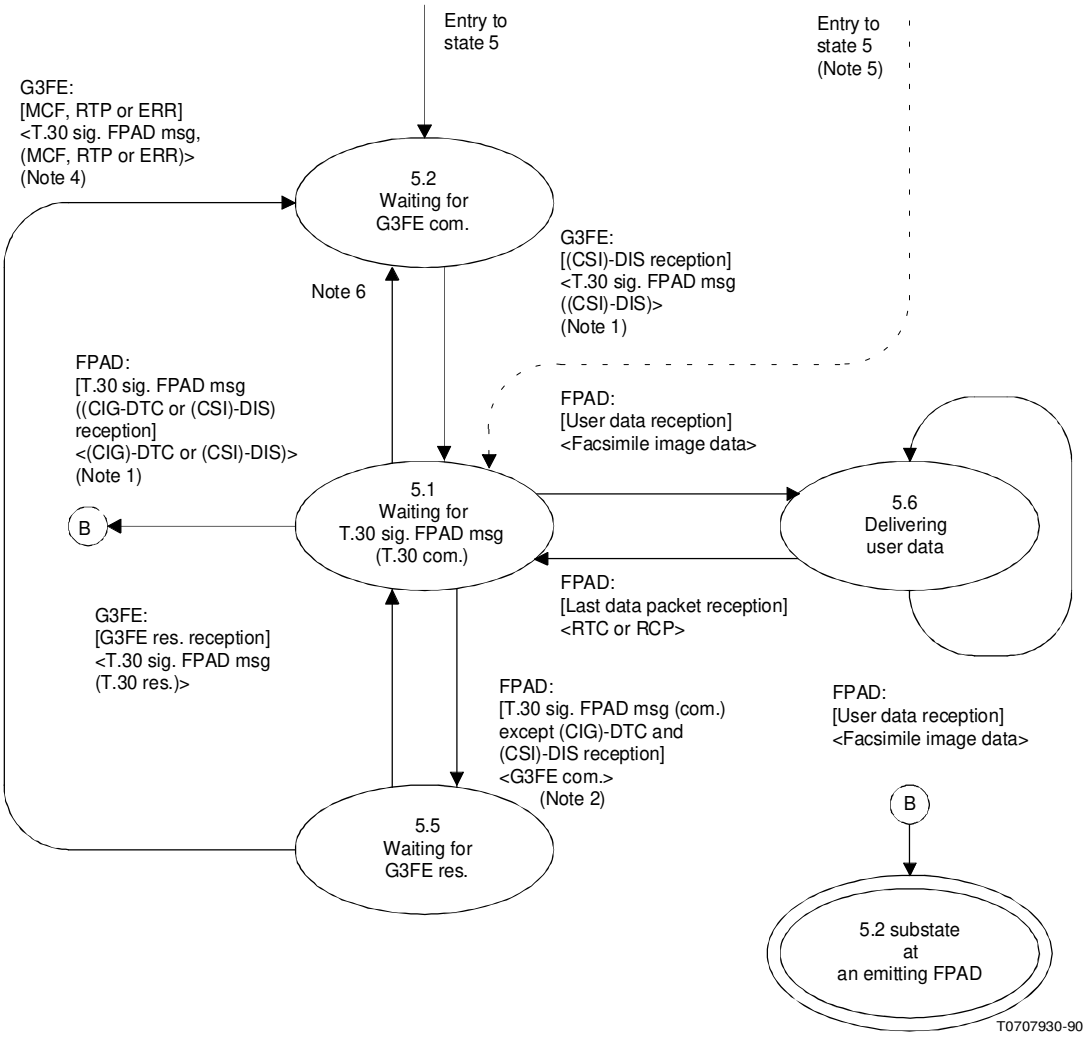
Substate diagram in facsimile procedure state (state 5) at an emitting FPAD (Note 3)



Note – If the virtual call is cleared while the interface is in state 5, 6, 7 or 8, the interface will enter the disconnected state.

FIGURE C-7/X.38

State diagram of call establishment and call clearing at a remote FPAD



Note 1 – The value in DIS or DTC may be changed in accordance with § 4.2.

Note 2 – In case of T.30 signal FPAD message [(CSI)-DIS], (CSI)-DIS followed by TCF is transmitted to the G3 facsimile equipment.

Note 3 – The conditions for leaving state 5 are defined in Figure C-7/X.38.

Note 4 – The conditions for this transition are described in § 4.1.2.3, b).

Note 5 – If the interface enters the facsimile procedure state upon receipt of (CSI)-DIS from G3FE, the interface enters substate 5.1.

Note 6 – The conditions for this transition are described in § 4.1.2.2, h).

FIGURE C-8/X.38

Substate diagram in facsimile procedure state at a receiving FPAD (Note 3)

ANNEX D

(to Recommendation X.38)

Support of non-standard facilities

D.1 In order for a G3 facsimile equipment to escape from standard procedures defined in Recommendation T.30 or T.4 to any non-standard mode, NSF (non-standard facilities), NSC (non-standard facilities command), NSS (non-standard set-up) frames are defined in Recommendation T.30.

D.2 The mechanism of non-standard facilities as defined in § D.3 is available as a mandatory function of the FPAD. However, actual implementation reflecting the values of non-standard facilities is a national matter.

D.3 When handling non-standard facilities, the FPAD should operate as follows:

D.3.1 *Modulation scheme*

a) If the FPAD supports the non-standard modulation scheme indicated in NSS, the FPAD operates accordingly.

b) If the FPAD does not understand or support the non-standard modulation scheme indicated in NSS:

- the emitting FPAD waits for a TCF signal at its highest speed and returns the response in accordance with § 4.5, and
- the receiving FPAD emits a TCF signal at its highest speed;
- the modem training will either:
  - succeed if the signalling rate falls back to its standard highest speed while retrying, or
  - fail if the signalling rate does not fall back to its standard highest speed while retrying. The call will be cleared after retrials by the originating G3 facsimile equipment.

Note – When an FPAD handles the non-standard modulation scheme without any knowledge on it, there is no explicit mechanism for providing signalling rate. As such, the possibility of failure of mode training may be higher than that in a standard mode case.

D.3.2 *Bit encoding scheme*

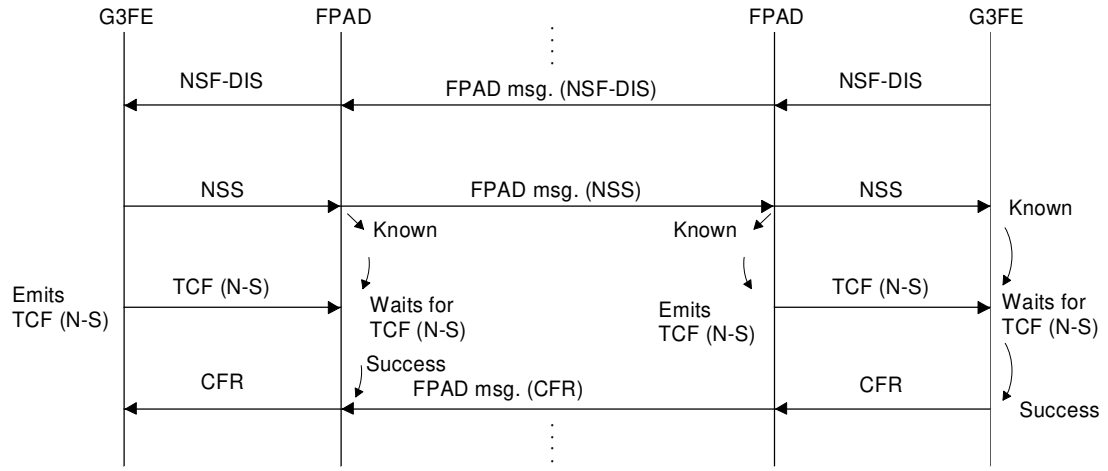
a) If the FPAD supports the non-standard bit encoding scheme indicated in NSS, the FPAD operates accordingly.

b) If the FPAD does not understand or support the non-standard bit encoding scheme indicated in NSS:

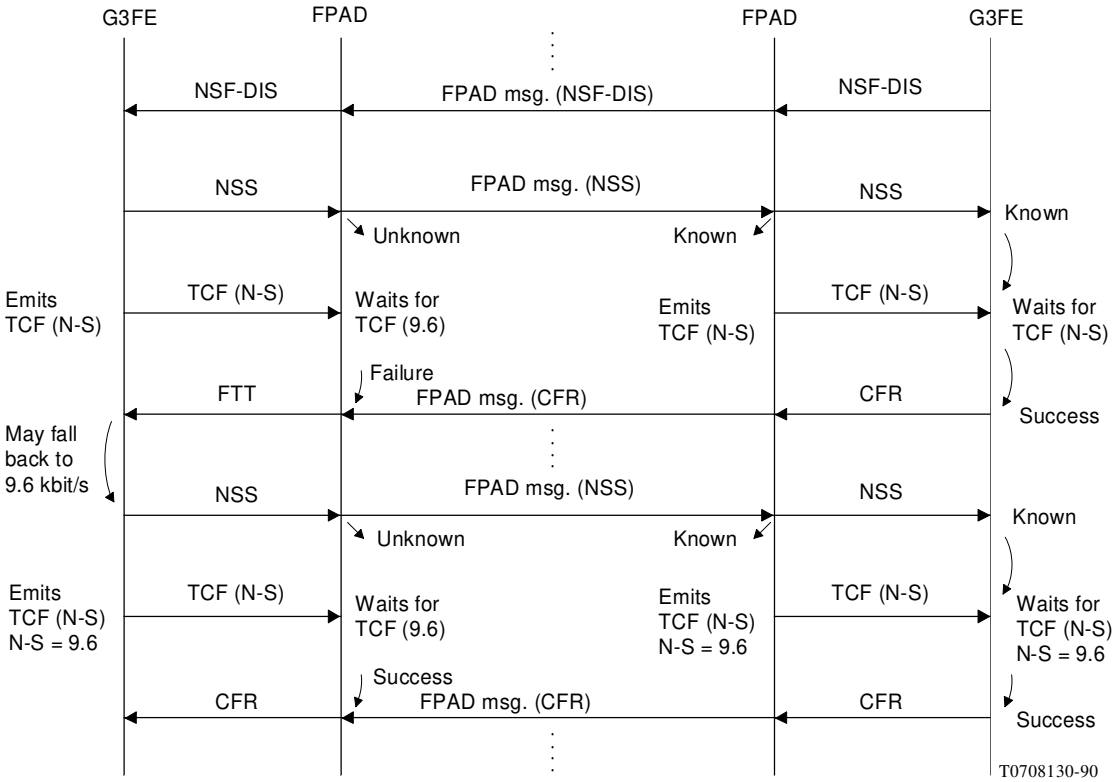
- the emitting FPAD forwards the facsimile image data transparently and the last packet regarding the "message carrier off" as the end of a page, and
- the receiving FPAD sends the forwarded facsimile image data to the G3 facsimile image data transparently.

Note 1 – When an FPAD handles the non-standard encoding scheme without any knowledge on it, there is no such flow mechanism as fill bits insertion/removal. As such, the possibility of the transmission failure due to time-out may be higher than that in a standard mode case.

Note 2 – "Message carrier" is defined in Recommendation T.30.



a) Both an emitting FPAD and a receiving FPAD support a non-standard mode



b) A receiving FPAD supports a non-standard mode, but an emitting FPAD does not

FIGURE D-1/X.38

Determination method of data signalling rate in case of non-standard mode

APPENDIX I

(to Recommendation X.38)

Examples of event sequence

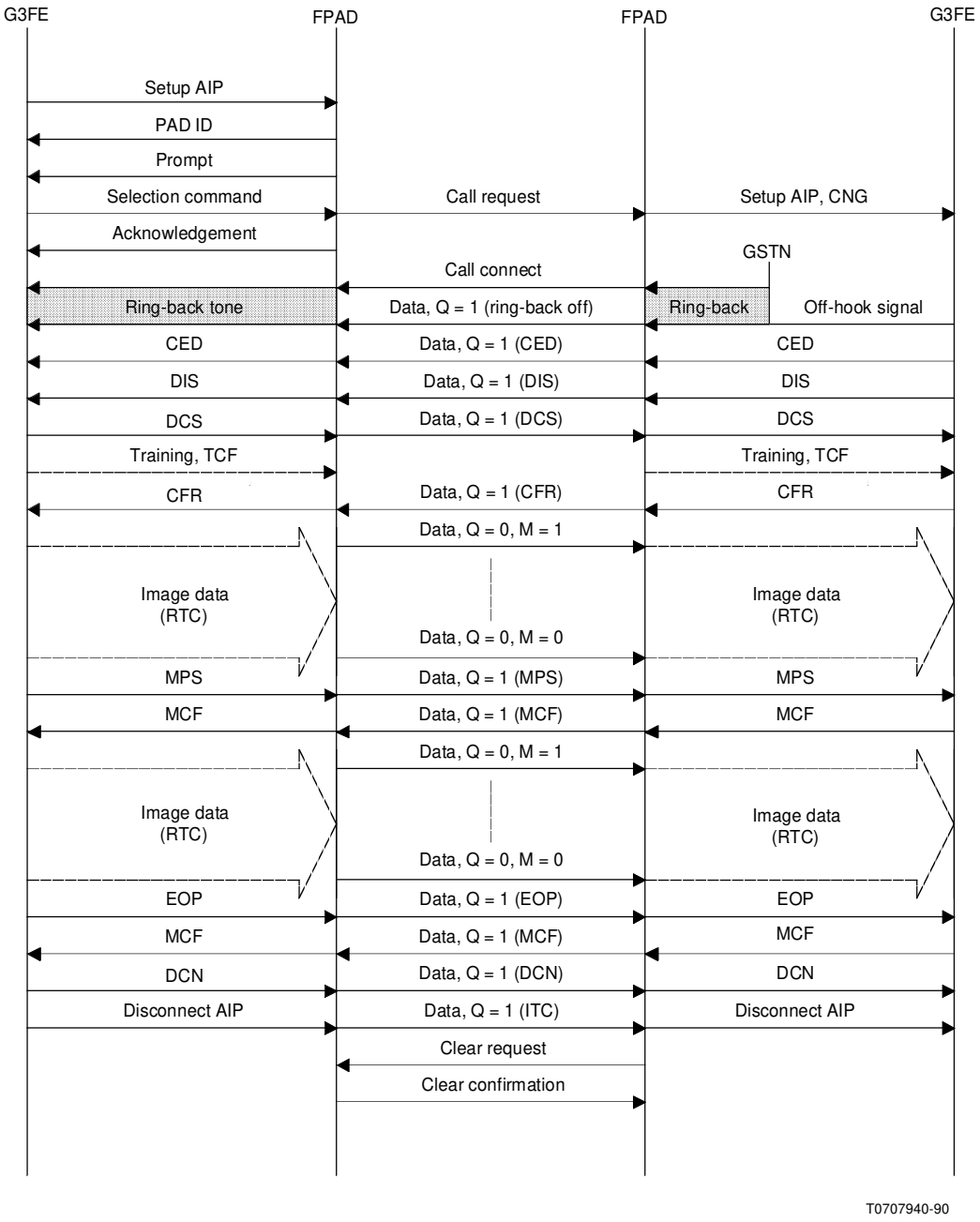
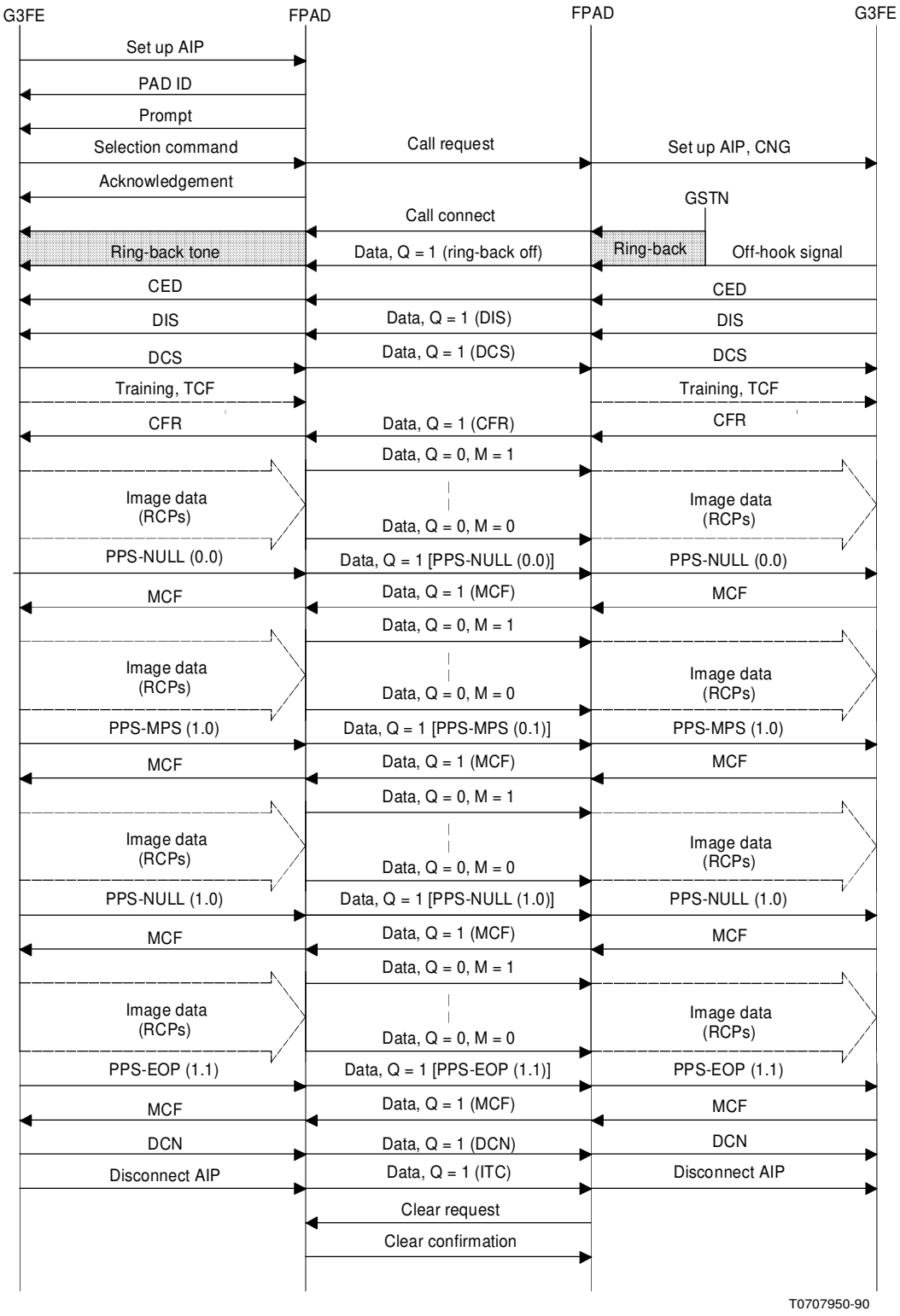


FIGURE I-1/X.38

Case of non-error correction mode transmission



Note – ECM is optionally supported by FPAD. See § 4.2.

FIGURE I-2/X.38

Case of error correction mode (ECM) transmission

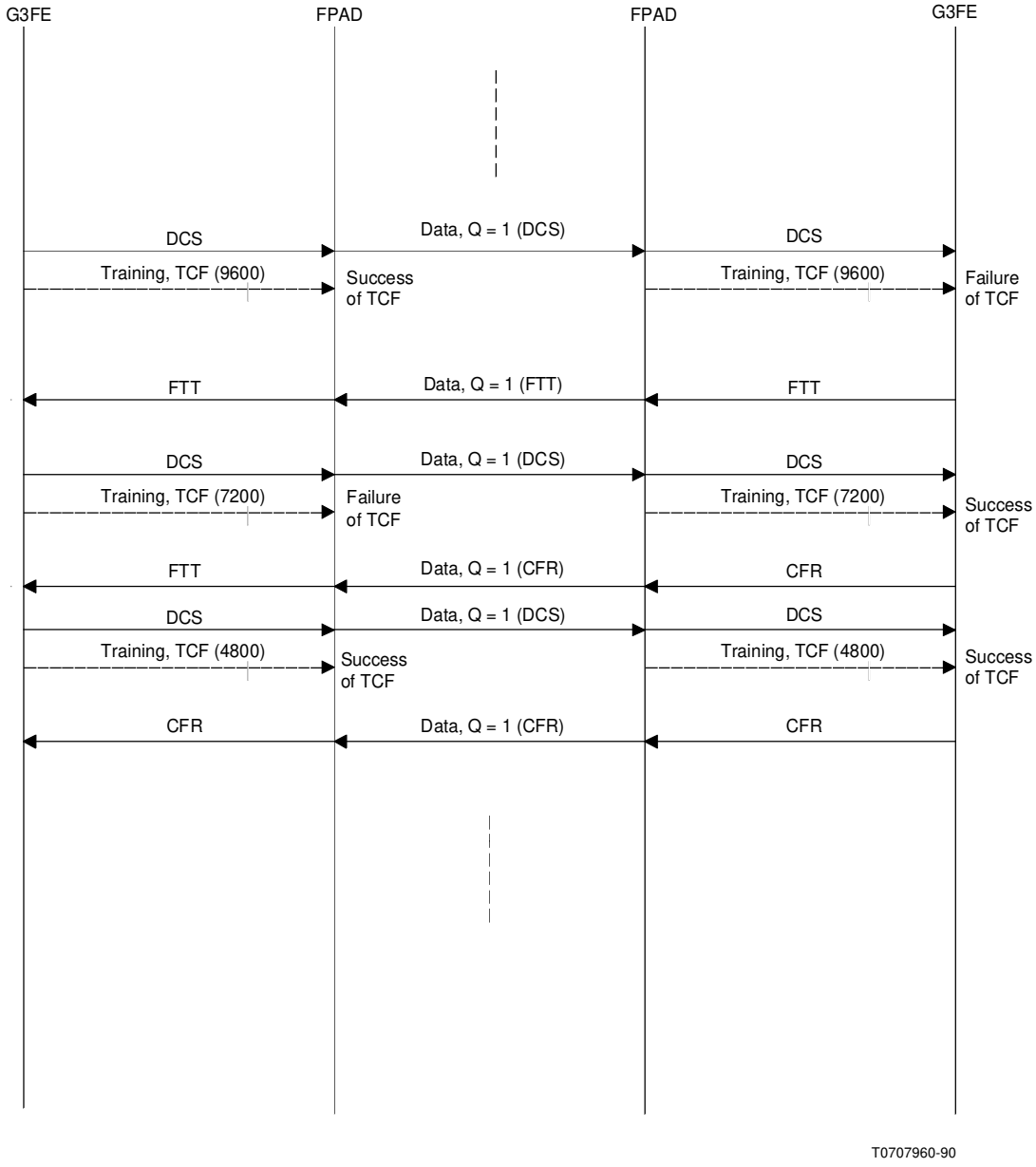


FIGURE I-3/X.38

Determination method of data signalling rate

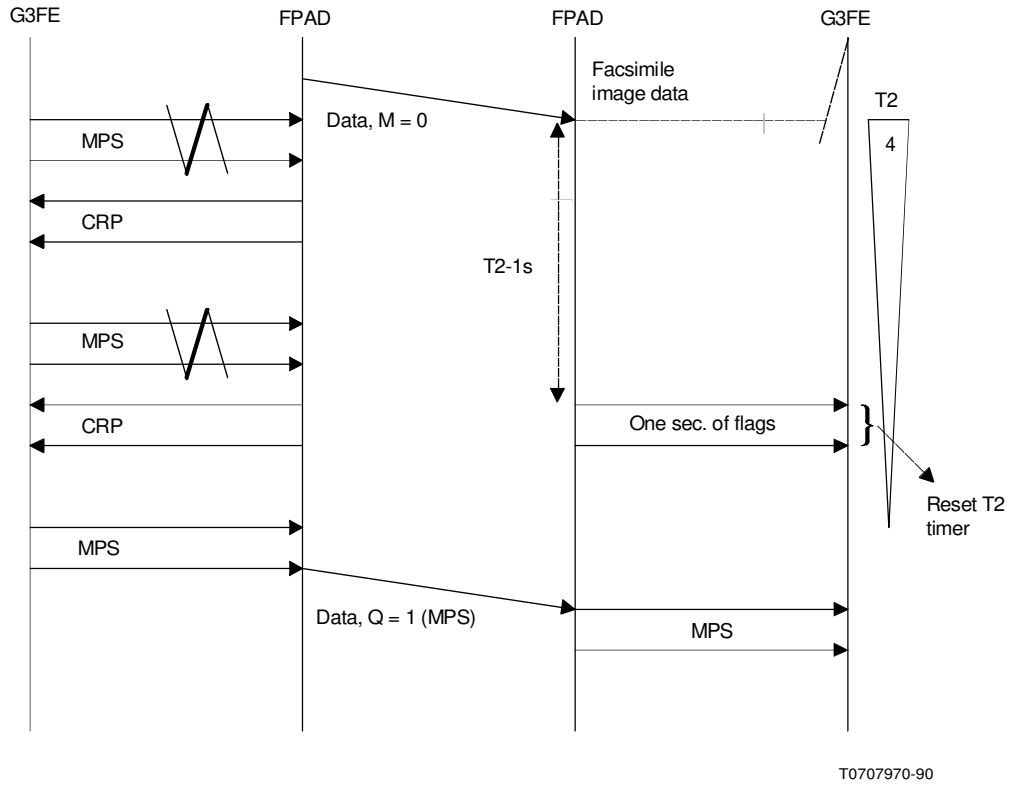


FIGURE I-4/X.38

Case of recovering from an error at the local side

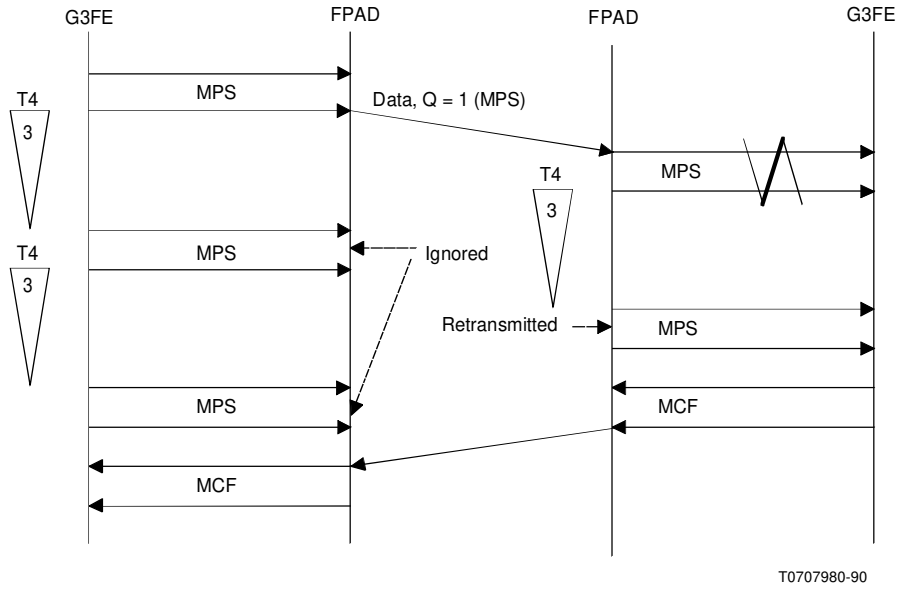


FIGURE I-5/X.38

Case of recovering from an error at the remote side

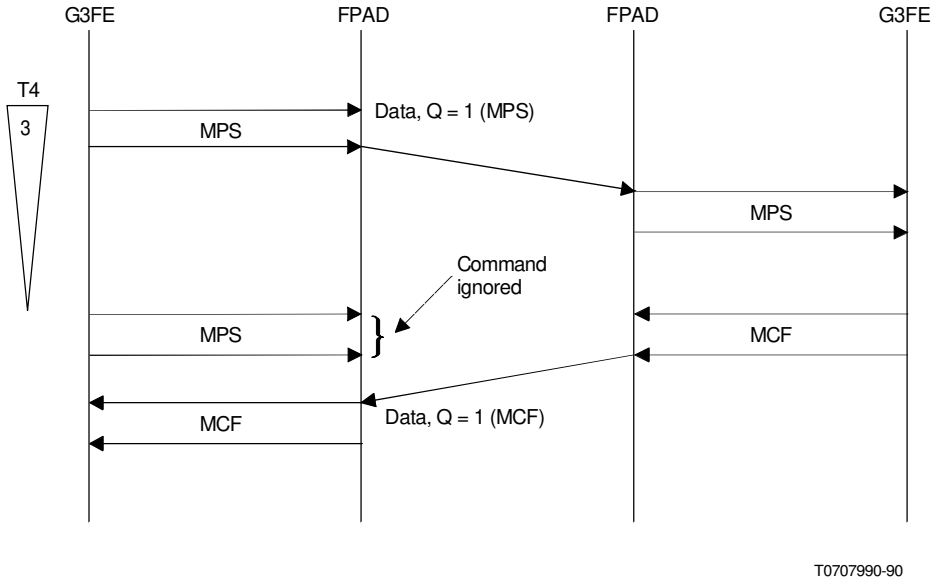
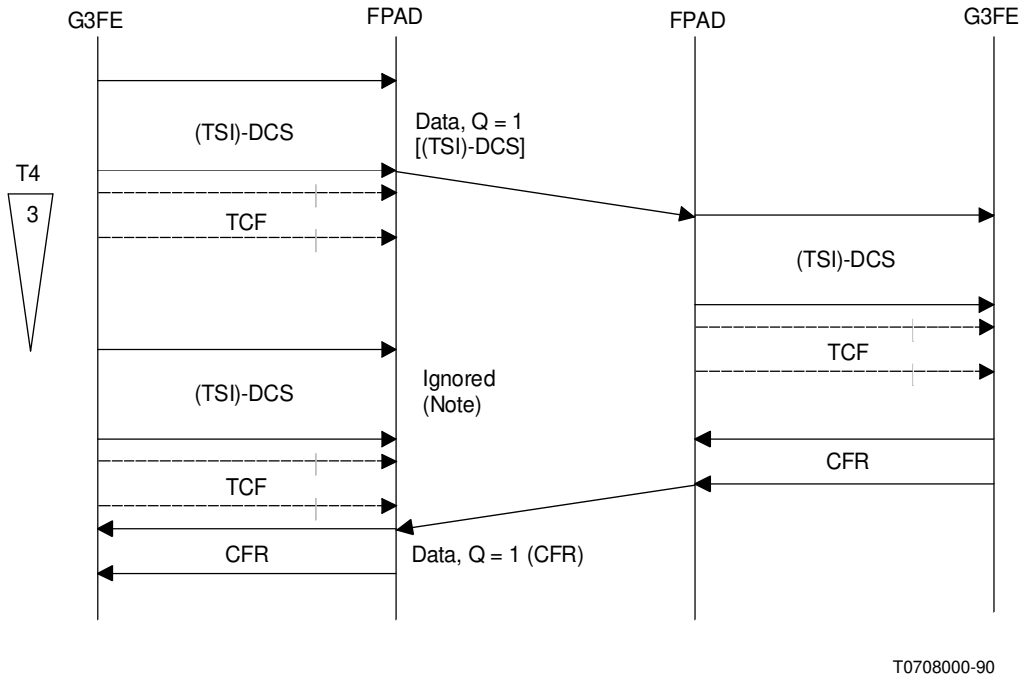


FIGURE I-6/X.38

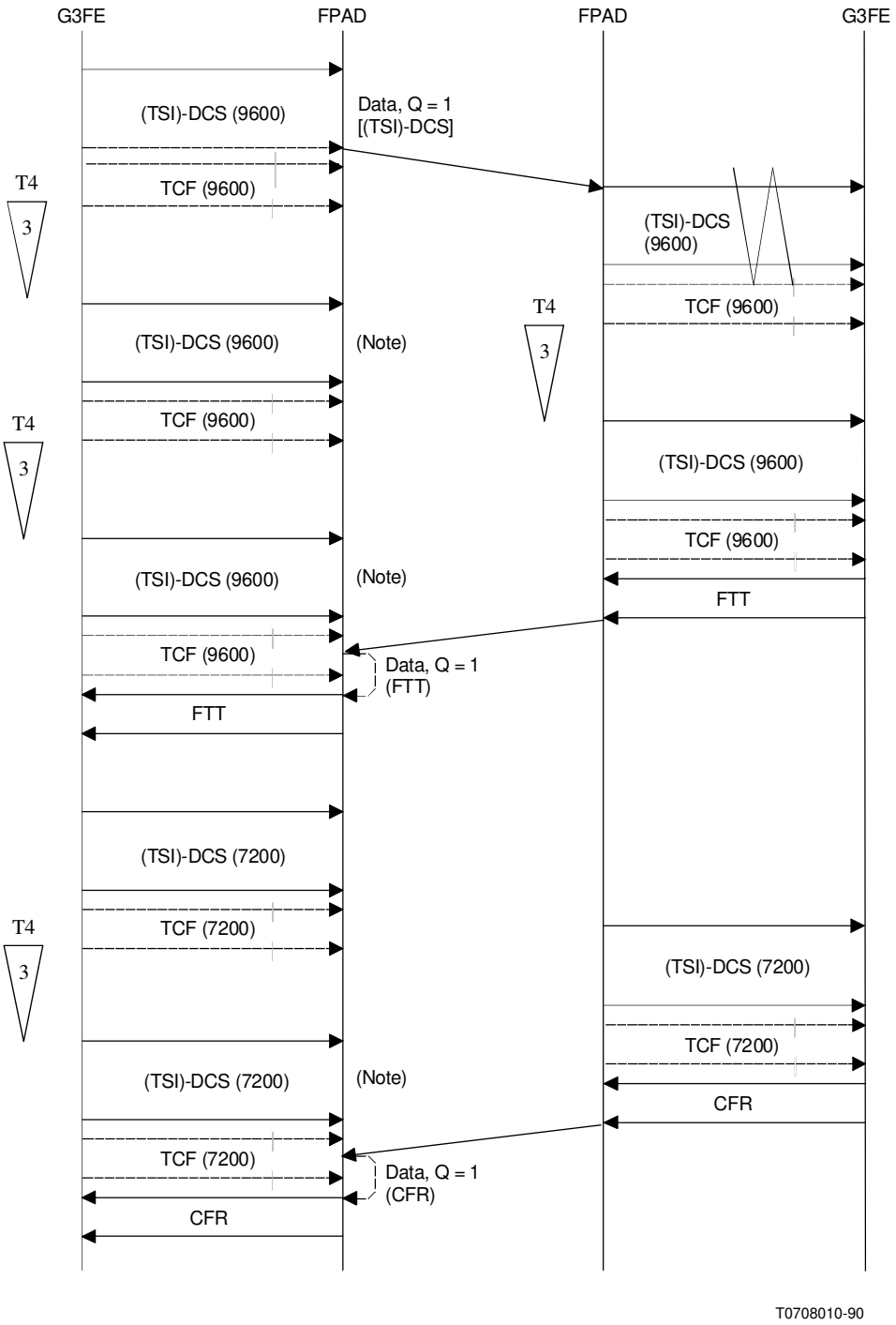
Case of recovering from delay in PSPDN (1)



Note – (TSI)-DCS will be ignored if it is identical to that previously received. The connection will be cleared in the other case.

FIGURE I-7/X.38

Case of recovering from delay in PSPDN (2)



Note – (TSI)-DCS will be ignored if it is identical to that previously received. The connection will be cleared in the other case.

FIGURE I-8/X.38

Case of recovering from an error in the data signalling rate negotiation

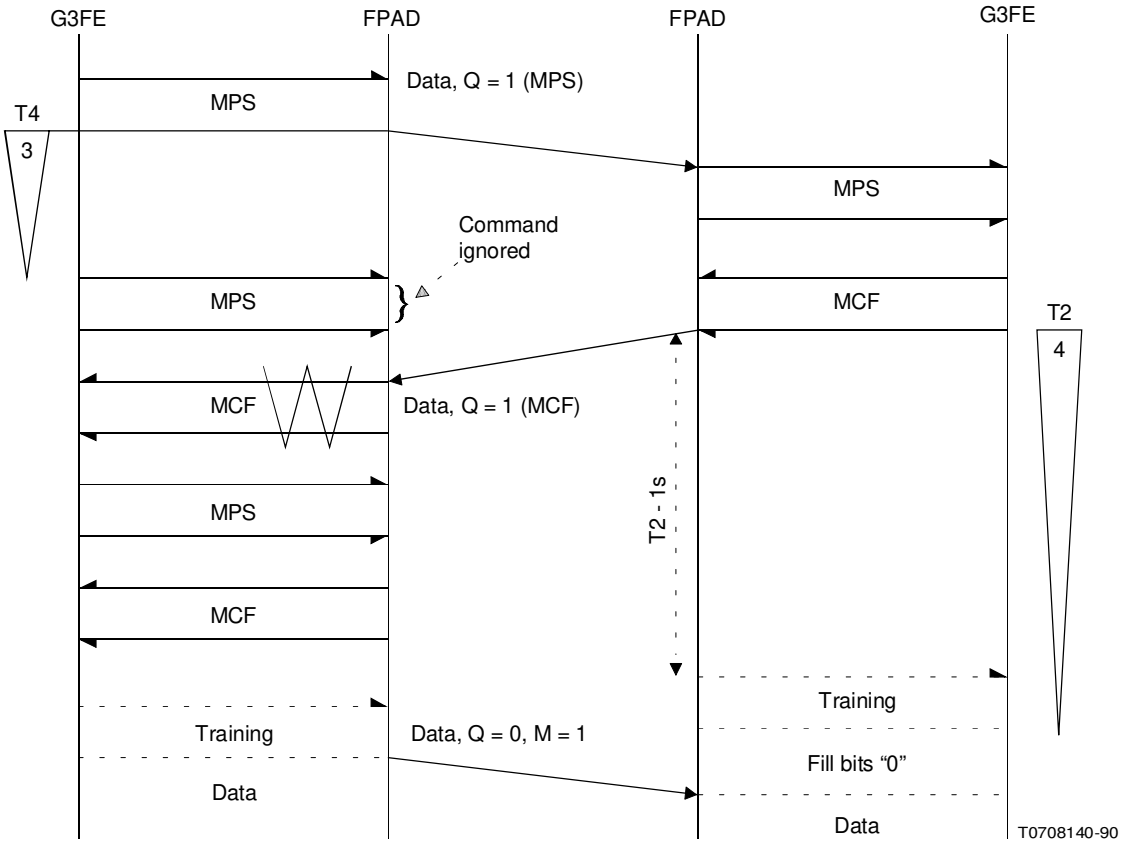


FIGURE I-9/X.38

Case of recovering from an error in the response at the local side

APPENDIX II

(to Recommendation X.38)

Alphabetical list of abbreviations used in this Recommendation

AIP	Access information path
CFR	Confirmation to receive
CIG	Calling subscriber identification
CSI	Called subscriber identification
DTMF	Dual-tone multi-frequency
ECM	Error correction mode
EOM	End of message
EOP	End of procedure
EOR-MPS	End of retransmission MPS
EOR-PRI-EOM	End of retransmission PRI-EOM
EOR-PRI-EOP	End of retransmission PRI-EOP
EOR-PRI-MPS	End of retransmission PRI-MPS
FPAD	Facsimile packet assembly/disassembly
FTT	Failure to train
G3FE	G3 facsimile equipment
GSTN	General switched telephone network
MPS	Multi-page signal
NSC	Non-standard facility command
NSF	Non-standard facility
NSS	Non-standard set-up
NUI	Network user identification
PIN	Procedure interrupt negative
PIP	Procedure interrupt positive
PPS-MPS	Partial page signal MPS
PPS-PRI-EOM	Partial page signal PRI-EOM
PPS-PRI-EOP	Partial page signal PRI-EOP
PPS-PRI-MPS	Partial page signal PRI-MPS
PRI-EOM	Procedure interrupt EOM
PRI-EOP	Procedure interrupt EOP
PRI-MPS	Procedure interrupt MPS
RTN	Retrain negative
RTP	Retrain positive