if a PDN entry point is to be reached via an intermediate network then the appropriate intermediate gateway is set in IDENT1 and further addressing is accomplished on the data channel in the format appropriate to that gateway.

b. The FAD field shall be set to '0' unless the PABX/PSTN destination address contains more than 9 digits.

c. Field PORT indicates the required called port.

d. Bit INTER is set to '1' if the calling party requires interactive contact with the called party.

e. Bit LEVEL indicates whether the calling party is requesting high priority for resources. For INTER = '1', this requests high priority for the complete path to the called party; for INTER = '0', it requests high priority only for the calling unit's link to the TSC.

f. Bit MODEM indicates whether the unit is able to operate at the customised transmission rate.

g. Bit HADT shall be set to '1' if high accuracy data transfer is thought to be supported by the TSC and is required.

The radio unit shall attempt access until:

i) it receives a valid response (see 17.1.2.1.2/3), or

ii) its user cancels the call (see 17.1.2.1.8), or

iii) the access attempt fails (i.e. the unit has sent the maximum number of transmissions NR/NDR and received no response, or its access time-out TC/TDC has expired (see 7.3.8 or 17.2.1.2.7)).

In this case:

- If the unit has not sent a request, it shall return to the state previous to the access attempt (and may indicate the failure to the service user).

- Otherwise, the unit shall wait for further call set-up signalling for the call; see 17.1.2.1.4 to 17.1.2.1.7.

17.1.2.1.2 Valid responses to short addressing RQD(E=0)

For a short addressing call, the calling unit shall accept the following messages as a valid response to its RQD and send no more requests:

a. An acknowledgement ACKI(QUAL=1), ACKQ, ACKX or ACKV, with the same prefix and idents as the RQD.

b. An acknowledgement ACKT(QUAL=0) with PFIX/IDENT2 as its individual address.

c. A Go To Transaction message GTT with PFIX/IDENT as its individual address, bit O/R set to '1', an acceptable RATE and, for a request on a data channel, CHAN set to the number of that data channel.

For other actions on receiving these messages, see sections 17.1.2.1.4 and 17.1.2.1.6, and 17.1.2.3.4 or 17.1.2.4.6.

17.1.2.1.3 Valid responses to extended addressing RQD(E=0)

For an extended addressing call, the calling unit shall accept the following messages (with the same prefix and idents as the RQD) as a valid response to its RQD and send no more requests:

a. An acknowledgement ACKI(QUAL=1), ACKV(QUAL=0) or ACKX.

b. AHYC (i.e. an instruction to send the full called address information).

For other actions on receiving these messages, see sections 17.1.2.1.4 and 17.1.2.1.5.

17.1.2.1.4 Acknowledgement received

If a radio unit attempting access or waiting for further call set-up signalling for a standard data call receives an appropriate acknowledgement then it shall take action as indicated below. (For extended addressing calls, only ACKI(QUAL=1), ACKV(QUAL=0) and ACKX are appropriate until the full address information has been sent.) For idents, see 5.5.2.1.

ACKI (QUAL=1)	-	Intermediate acknowledgement; more signalling to follow.
ACKQ (QUAL=0)	-	All data channels are busy. Wait for further signalling.
ACKQ (QUAL=1)	-	Called party engaged. Wait for further signalling.
ACKX (QUAL=0)	-	Call adjudged to be invalid by TSC or called party; request rejected.
ACKX (QUAL=1)	-	System overload, or for INTER='1' the called party is engaged or will not interact at this time, and the TSC has not queued the call; request rejected.
ACKV (QUAL=0)	-	Called unit not in radio contact or call set-up abandoned.
ACKV (QUAL=1)	-	Call not queued because the called party is unable to receive a call with the required facilities, e.g. the radio unit does not support HADT or interaction or cannot accept the requested PORT.
ACKT (QUAL=0)	-	Called party's calls have been diverted.

If ACKI(QUAL=1) or ACKQ is received, the unit shall wait for further signalling and may indicate to the service user the progress of the call.

If ACKX or ACKV is received, the unit shall return to the state previous to the call request and may indicate to the service user the reason for the failure of the call; it is recommended that receipt of ACKV(QUAL=0), ACKV(QUAL=1), ACKX(QUAL=0), and ACKX(QUAL=1) each be indicated in its own distinct manner.

If a complete ACKT(QUAL=0) message is received, the unit shall either:

a. return to the state previous to the call request (and may indicate to the service user that the called party's calls have been diverted), or

b. wait for a time (TB on the control channel, TDB on the data channel) (see below), and then attempt a new call to the diversion address given in the ACKT message:

- if IDENT1 does not equal IPFIXI or PSTNGI or PABXI, try on IDENT1;

- if IDENT1 = IPFIXI or PSTNGI or PABXI, try the alternative called party given in the appended data codeword(s).

Note that ACKT(QUAL=0), with IDENT1 = IPFIXI and an appended data codeword, indicates either an interprefix diversion address or that the diversion address is of a different type from the original called address. Flag GF in the appended data codeword specifies whether the diversion address is an individual or group address; see 5.5.2.1.

If an incomplete ACKT(QUAL=0) message is received (i.e. if not all the appended data codewords are decodeable), then:

i) If the unit does not require the diversion address, it shall return to the previous state (and may give an indication to the service user).

ii) If the unit does require the diversion address then:

- if still attempting access for the call, it shall ignore the message and continue to attempt access;

- otherwise it shall wait for a repeat ACKT, returning to the previous state if a time TB/TDB elapses (in which case, it may indicate the failure to the service user).

After receiving ACKX or ACKV for the call, the unit shall not request another non-emergency call of any type to the same called ident (or gateway) for at least a time TB/TDB. After receiving ACKT for the call, the unit shall not request another non-emergency call of any type for at least a time TB/TDB.

17.1.2.1.5 Instruction to send address information

A radio unit that is requesting an extended addressing standard data call on a control channel shall follow the procedure in 9.2.2.1 for sending the full address information, but with a revised check on the SLOTS field from the AHYC. The check that "SLOTS corresponds to the request", for an extended addressing data call, shall be taken as:

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If IDENT1 = PSTNGI and unit's call requires > 9 PSTN digits
                          then SLOTS = '10'.
If IDENT1 = PSTNGI and unit's call requires < 10 PSTN digits
                          then SLOTS = '01' or '10'.
If IDENT1 not equal to PSTNGI
                          then SLOTS = '01'.
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The procedure for sending extended addressing information for a data call requested on a data channel is specified in section 17.1.2.4.1.

17.1.2.1.6 Availability check and channel command for own call

A calling radio unit attempting access or waiting for further call set-up signalling for a standard data call shall obey the appropriate availability check and channel command procedures (see 9.2.2.2 to 9.2.2.5 and 17.1.2.3.1 to 17.1.2.3.4, or 17.1.2.4.2 to 17.1.2.4.6).

It shall assume that a GTT message it receives is for its requested standard data call if PFIX/IDENT is its individual address, bit O/R is set to '1', RATE is acceptable and, for a GTT on a data channel, CHAN is set to the number of that data channel. If also TRANS > '0000000000' then the unit shall regard the call link as established and may give an indication to the service user.

17.1.2.1.7 Time-out after waiting

A calling radio unit waiting for further call set-up signalling on the channel on which it attempted access for a standard data call shall return to the previous state if a time TW/TDW has elapsed since the last message it sent for the call, viz.

RQD, requesting the standard data call (see 17.1.2.1.1)

or SAMIS, providing extended address information for the call (see 17.1.2.1.5)

or ACK(QUAL=0), sent in response to an AHY message with bit POINT = 1 and IDENT1 as the called ident or gateway (see 9.2.2.3 or 17.1.2.4.2).

It may also indicate the failure to the service user.

17.1.2.1.8 Call cancellation

If the service user wishes to cancel the call, and the unit has not yet sent an RQD, then it shall return immediately to the previous state. Otherwise, if the unit has sent an RQD, it shall attempt to send a call cancellation request RQX (see 5.5.3.1.3), complying with the appropriate random access protocol. It shall attempt access until one of the following occurs:

a. It receives ACK(QUAL=1), with the same prefix and idents as the RQX, confirming cancellation of the call.

b. It receives ACKX, ACKV or ACKT(QUAL=0) for the call it is attempting to cancel. See also 17.1.2.1.4.

c. It receives a GTT message for the call it is attempting to cancel; in this case, it shall obey the GTT procedure (see 17.1.2.3.4 or 17.1.2.4.6), though it may then terminate the transaction.

d. It has sent the maximum number of transmissions NR/NDR and received no response, or it's access time-out TC/TDC has expired. In this case, it shall return to waiting for signalling for the standard data call (see 17.1.2.1.4 to 17.1.2.1.7).

In cases a. and b., the unit shall return to the previous state.

17.1.2.2 Procedures for Radio Units Requesting Emergency Standard Data Calls

A radio unit shall make only one emergency call set-up attempt at a time. While attempting access or waiting for further call set-up signalling for an emergency request, the unit shall not request another call of any type (unless the user first cancels the original call). It may make an emergency call at any other time. For example, it may interrupt a non-emergency call set-up attempt to request an emergency call; in this case it shall abandon the previous call attempt (without sending RQX).

17.1.2.2.1 Request for an emergency standard data call

A radio unit requests an emergency standard data call by sending an RQD(E=1) message on a control channel or data channel. The fields in the RQD message shall be set appropriately (see 5.7.1). Some TSCs may permit more than one emergency random access transmission in a frame; however, unless the radio unit knows the retry rate permitted by the TSC, it shall comply with the appropriate normal random access protocol - see 7.3 or 17.2.1.2.

The unit shall attempt access until it receives a valid response (see 17.1.2.2.2), or until its user cancels the call (see 17.1.2.2.7), or until the access attempt fails (i.e. the unit has sent the maximum number of transmissions (NE for the control channel, NDE for the data channel) and received no response, or its access time-out TC/TDC has expired). In the case of access failure, if the unit has not sent a request, it shall return to the previous state (and may indicate the failure to the service user); otherwise, it shall wait for further call set-up signalling for the call - see 17.1.2.2.3 to 17.1.2.2.6.

17.1.2.2.2 Responses to RQD(E=1)

The calling unit shall accept the following messages (with the same prefix and idents as the RQD) as a valid response to its emergency RQD and send no more requests:

a. An acknowledgement ACKE(QUAL=0).

b. An AHYD message with bits POINT and E set to '1'.

It shall then wait for further signalling for the call. See also section 9.2.2.3 or 17.1.2.4.2.

17.1.2.2.3 Sending extended address information

For an extended addressing emergency standard data call, after receiving ACKE(QUAL=0) or AHY(POINT=1,E=1) for its call, the calling unit shall send the full called address information on receipt of an appropriate AHYC; see section 17.1.2.1.5.

Until it receives ACKE(QUAL=0) or AHY(POINT=1,E=1), the unit shall respond to Mode 1 AHYC messages with ACKX(QUAL=0).

17.1.2.2.4 Acknowledgements indicating progress of call

After receiving ACKE(QUAL=0) or AHY(POINT=1,E=1) for its emergency standard data call, the waiting calling unit shall take appropriate action on receiving further acknowledgements -ACKI(QUAL=1), ACKQ, ACKX, ACKV or ACKT(QUAL=0) - as detailed in section 17.1.2.1.4.

Until it receives ACKE(QUAL=0) or AHY(POINT=1,E=1), the unit shall ignore other acknowledgements.

If it receives ACKE(QUAL=0) for the call then the unit shall wait for further signalling.

17.1.2.2.5 Availability check and channel command for own call

A calling radio unit attempting access or waiting for further call set-up signalling for an emergency standard data call shall obey the availability check procedures (see 9.2.2.2 to 9.2.2.4, 17.1.2.3.1 and 17.1.2.3.2, or 17.1.2.4.2 to 17.1.2.4.4).

The unit shall also obey the channel allocation procedures (see 9.2.2.5 and 17.1.2.3.4 or 17.1.2.4.6). Note particularly that:

i) On a control channel:

a. If the unit has not received ACKE(QUAL=0) or AHY(POINT=1,E=1) for its emergency call, it shall ignore all GTT and GTC messages.

b. After receiving ACKE(QUAL=0) or AHY(POINT=1,E=1) for its emergency call, the unit shall obey a GTT or GTC message only if it is individually addressed by the GTT or GTC.

ii) On a data channel:

If the unit has not received ACKE(QUAL=0) or AHY(POINT=1,E=1) for its emergency call, it shall ignore individually addressed GTT messages with bit O/R set to '1'.

See rule 1 of sections 9.2.2.5 and 17.1.2.3.4, or section 17.1.2.4.6b.

After receiving ACKE(QUAL=0) or AHY(POINT=1,E=1) for a short addressing call or after sending the full address information for an extended addressing call, the unit shall assume that a GTT message it receives is for its requested call if PFIX/IDENT is its individual address, bit O/R is set to '1', RATE is acceptable and, for a GTT on a data channel, CHAN is set to the number of that data channel. If also TRANS > '0000000000' then the unit shall regard the call link as established and may give an indication to the service user.

17.1.2.2.6 Time-out after waiting

A calling radio unit waiting for further call set-up signalling on the channel on which it attempted access for an emergency standard data call shall return to the previous state if a time TW/TDW has elapsed since the last message it sent for the call, viz.

RQD(E=1), requesting the emergency call (see 17.1.2.2.1)
or SAMIS, providing extended address information for the call
or ACK(QUAL=0), sent in response to an AHY message with POINT = 1, E = 1 and IDENT1 as the called ident or gateway. It may also indicate the failure to the service user.

17.1.2.2.7 Other procedures

a. A calling radio unit waiting for an emergency standard data call may attempt to cancel the call by sending a call cancellation request RQX. The procedures are as defined in 17.1.2.1.8 for cancelling non-emergency data calls.

b. The procedures on the data channel are as defined in 17.2.

17.1.2.3 Related Procedures for All Radio Units on a Control Channel

These procedures shall be obeyed by all radio units that are equipped to send or receive standard data.

A radio unit attempting access or waiting for further signalling for a call may be sent a data availability check message AHYD or Go To Transaction message GTT for an incoming call (see 17.1.2.3.1A and 17.1.2.3.4). Note that:

i) The unit can reject an incoming individual standard data call by sending ACKV(QUAL=1) in response to the AHYD message.

ii) A radio unit is required to obey individually addressed GTT messages and system-wide calls (except in emergency), though it may ignore group call GTTs. However, if making a call of its own, the unit is required to ignore GTT messages for incoming group calls; see 17.1.2.3.4. This rule applies also to a unit that has received an AHY or AHYD message for an incoming individual traffic channel or data call and responded with ACK(QUAL=0) or ACKI(QUAL=0).

iii) If a unit receives and obeys a GTT message not for its own call, it returns to its previous state at the end of the incoming call, unless the time-out (e.g. TW or TDW) on the previous state has expired.

17.1.2.3.1 Data availability/rate check on individually called radio unit

If a radio unit on a control channel receives an AHYD message with PFIX/IDENT1 matching its individual address then it shall respond with the appropriate acknowledgement (see below), with the same prefix and idents as the AHYD. If bit AD = 0 in the AHYD message, the unit shall respond in the slot following the AHYD address codeword; if bit AD = 1, a data codeword is appended (containing the calling address) and the unit shall respond in the slot following the data codeword. For timing, see 6.2.1.3.

A) Incoming standard data call : IDENT2 not equal to DUMMYI

The unit shall send one of the following acknowledgements:

ACKX (QUAL=0) if it is not equipped to accept standard data calls at least from this calling party.

ACKX (QUAL=1) if it cannot accept this standard data call at this time (e.g. its data store is full or interaction has been requested but is not immediately possible).

ACKV (QUAL=1) if it does not support one or more of the requested facilities, i.e. does not support HADT or interaction or cannot accept the wanted PORT.

ACKB (QUAL=1) if AD = 1 in the AHYD message but the appended data codeword was not decodeable and the unit requires the message to be retransmitted.

ACK (QUAL=0) if it is available for a standard data call of this type; in this case, the unit shall set bit MODEM to indicate whether it is able to operate at the customised transmission rate; see 5.5.2.2.

The unit may indicate to its user the caller (by reference to PFIX/IDENT2 from the AHYD message or PFIX2/IDENT2 from the data codeword) and whether interaction is required, and whether the incoming call is an emergency call (by reference to bit E from the AHYD).

Note that, unlike AHY for traffic channel calls, there is no option for the radio unit to respond to AHYD with an intermediate acknowledgement ACKI(QUAL=0), followed by use of a called party answer mechanism; the unit must either accept or reject the data call. (If the data equipment is not ready immediately, the radio unit could receive and buffer the first data

transmission(s), and then introduce a pause using the Flow Control mechanisms on the data channel.)

After receiving an AHYD message for an incoming individual standard data call and responding with ACK(QUAL=0), the unit shall ignore:

- group call GTC messages as specified in section 9.2.2.5 rule 2 or 3,

- group call GTT messages as specified in section 17.1.2.3.4 rule 2 or 4,

until either:

a. it receives a channel command for the incoming data call (i.e. a GTT message with PFIX/IDENT as its individual address, bit O/R set to '0' and an acceptable RATE), or

b. it assumes that the call will not take place; see 17.1.2.3.2.

If, while waiting for an incoming individual standard data call, a radio unit receives a repeat AHYD then it shall send the appropriate acknowledgement; also, for ACK(QUAL=0), it shall restart its timer TA/TDA (see 17.1.2.3.2).

If, while waiting for an incoming traffic channel call (having sent ACK(QUAL=0) or ACKI(QUAL=0) in response to an AHY message), a radio unit receives an AHYD for an incoming individual standard data call, the unit shall abandon the old call and obey the AHYD; also, if currently attempting an "off-hook" or "on-hook" RQQ transaction for the original call, it shall abandon the RQQ transaction - see 13.1.2.

B) "No-call" test availability check : IDENT2 = DUMMYI

The unit may indicate that it is not suitably equipped by sending ACKX(QUAL=0). Otherwise it shall send ACK(QUAL=0).

ACKX (QUAL=0) - The unit could not at any time accept a standard data call with all the specified facilities.

ACK (QUAL=0) - Unit is in radio contact and is suitably equipped to support the particular parameter settings in the AHYD. Bit MODEM indicates whether it is able to operate at the customised transmission rate.

17.1.2.3.2 Cancelling waiting state of individually called radio unit

A radio unit that has received an AHYD message for an incoming individual standard data call (see 17.1.2.3.1A), and responded with ACK(QUAL=0), shall assume that the call will not take place if one of the following occurs:

a. It has not received a GTT message for the call at a time TA/TDA after the last ACK(QUAL=0) it sent in response to an AHYD for the call.

b. It receives an AHYX message with the same prefix and idents as the AHYD. (The unit shall respond in the next slot with ACK(QUAL=1), as required by section 9.2.2.4.)

c. It receives an AHYD message checking its availability for a different incoming individual standard data call (i.e. bit E and/or the calling address and/or the PORT is different from the original AHYD).

d. It receives an AHY message checking its availability for an incoming traffic channel call.

The unit may indicate to the service user that the expected data call will not take place. In cases a. and b., the unit shall note that:

- rule 2 or 3 of section 9.2.2.5, and

- rule 2 or 4 of section 17.1.2.3.4

(requiring the unit to ignore GTC/GTT messages for incoming group calls) no longer apply. In case c., the unit shall obey the procedures in 17.1.2.3.1A for the new call. In case d., the unit shall obey the procedures in 9.2.2.2A for the new call.

17.1.2.3.3 Receiving AHYD message addressed to a group or ALLI

If a radio unit on a control channel receives an AHYD message with

PFIX/IDENT1 matching any of its group addresses for this system or

IDENT1 set to the system-wide all-call ident ALLI

then it may accept the call information contained in the AHYD codeword, but shall transmit no response. The unit may then assume that the next GTT(O/R=0) message for this respective group or ALLI address received on this channel within the following time TA/TDA corresponds to the:

i) calling address
(PFIX/IDENT2 or PFIX2/IDENT2 from an appended data codeword)

ii) E bit

iii) PORT

announced by the AHYD message.

If the unit has not received a GTT(O/R=0) message at a time TA/TDA after the last received AHYD for the call, or if it receives an AHYD message for different call to this address, then it may assume that the expected call will not take place.

17.1.2.3.4 Data channel assignment

A radio unit on a control channel shall check all GTT messages it receives to see whether the message is addressed to it, that is, whether:

PFIX/IDENT from the GTT message matches its individual address or

PFIX/IDENT matches any of its group addresses for this system or

IDENT is the system-wide all-call ident ALLI.

If the GTT message is addressed to it, and it is able to receive standard data at the transmission rate specified by field RATE, the unit shall use the appropriate rule below to decide whether to obey the command:

1. If the unit is making an emergency call (RQE or RQD(E=1)) and has not received ACKE(QUAL=0) or AHY(E=1) for its call, it shall ignore the GTT message.

   If the unit is waiting for further signalling for its emergency call, after receiving ACKE(QUAL=0) or AHY(E=1) for the call, it shall obey the GTT message if and only if it is individually addressed by the GTT (i.e. its individual address is PFIX/IDENT).

2. Otherwise:
   If the unit is waiting for an incoming individual emergency call (see 9.2.2.2A and 17.1.2.3.1A), it shall obey the GTT message if and only if it is individually addressed by the GTT.

3. Otherwise:
   If the unit is attempting access or waiting for further signalling for a non-emergency call or transaction, it shall obey the GTT message if and only if:

   it is individually addressed by the GTT,

   or IDENT is set to ALLI and the unit knows that it is not the calling unit (i.e. it is not making a system-wide standard data call or has received an AHYD message indicating another caller - see 17.1.2.3.3).

4. Otherwise:
   If the unit is waiting for an incoming non-emergency individual traffic channel or data call (see 9.2.2.2A and 17.1.2.3.1A), it shall obey the GTT message if and only if:

   it is individually addressed by the GTT,

   or IDENT is set to ALLI (unless the unit has received an AHYD message indicating that it was the calling party in the call).

5. Otherwise (i.e. if not waiting for any call or transaction):

The unit shall obey the GTT message, unless:

IDENT is set to ALLI and the unit has received an AHYD message indicating that it was the calling party in the call

or PFIX/IDENT is one of the unit's group addresses and the unit cannot or does not wish to accept this call, for example:

- the service user does not wish to receive group calls, or
- the unit has received an AHYD message for this group address indicating that it was the calling party in the call, or
- the unit has received an AHYD message for this group address indicating an unacceptable calling party or PORT, or
- the unit has not received an AHYD message for this group address and it needs the AHYD information for reliable operation (e.g. some calls to this address are of normal accuracy whilst others employ HADT).

If the unit is required to obey the GTT command, it shall perform the following actions:

a. The unit shall tune to the designated forward channel and shall be able to receive on the data channel within 35 ms after the end of the GTT message.

It shall be prepared to receive signalling at the transmission rate specified by field RATE in the GTT message.

b. If bit O/R from the GTT message is set to '1', the unit shall note that it is the calling party. Otherwise it is a called party.

Note that, if the unit is a called party and is waiting for an incoming standard data call for this address (see 17.1.2.3.1 and 17.1.2.3.3), then it may take the PORT and the calling address (if fully supplied) from the AHYD message.

c. The unit shall note PFIX, IDENT and TRANS from the GTT message.

i) For TRANS > '0000000000', the unit shall expect to receive signalling on the data channel for this transaction number.

ii) For TRANS = '0000000000', the unit shall expect to receive a further GTT message on the data channel to assign a transaction number for the link. The unit shall assume that the next GTT message, containing this address, bit O/R and bit RATE, and with CHAN equal to the number of the data channel, received within the following time TDG, corresponds to this call - see 17.1.2.4.6a.

If a calling unit has not received the expected GTT(O/R=1) message on the data channel at a time TDG after the control channel GTT, then it shall return to the idle state on the control channel and may indicate the call failure to the service user.

If a called unit has not received the expected GTT(O/R=0) message on the data channel at a time TDG after the control channel GTT, or if it receives an individually addressed AHYD message for a different call to this address, then it shall assume that the expected call will not be received and may give an indication to the service user.

d. The unit shall note the channel number of the control channel.

It may also give an indication of the event to the service user.

If the unit does not obey a GTT message, and the designated data channel is the control channel on which the message was received, then the unit shall enter the control channel acquisition procedures.

17.1.2.4 Related Procedures for All Radio Units on a Data Channel

These procedures shall be obeyed by all radio units which are equipped to request or receive calls on a data channel. (Other procedures for radio units on a data channel are included in sections 17.2.)

17.1.2.4.1 Instruction to send extended address information

This procedure shall be obeyed by all radio units that are equipped to request extended addressing standard data calls.

If a radio unit on a data channel receives an AHYC message with PFIX/IDENT2 matching its individual address then it shall either send address information or transmit ACKX(QUAL=0), as indicated below. For timing on a 1200 bit/s data channel, see section 6.2.1.3.

If the unit has sent an extended addressing RQD(E=0) request, or has received ACKE or AHY(E=1) for an extended addressing RQD(E=1)

and IDENT1 matches IDENT1 from the request

and DESC is appropriate to IDENT1 (see 5.5.3.2.8)

and SLOTS corresponds to the request

(i.e. if IDENT1 = PSTNGI and unit's call requires > 9 PSTN digits then SLOTS = '10'

if IDENT1 = PSTNGI and unit's call requires < 10 PSTN digits then SLOTS = '01' or '10'

if IDENT1 is not equal to PSTNGI then SLOTS = '01')

then it shall transmit the full called address information, conforming to the codeword formats defined in section 5.6.1.2.2 (SAMIS, Mode 1).

Otherwise

the unit shall transmit ACKX(QUAL=0), with the same prefix and idents as the AHYC.

17.1.2.4.2 Data availability/rate check on individually called radio unit

If a radio unit on a data channel receives an AHYD message with PFIX/IDENT1 matching its individual address then it shall respond with the appropriate acknowledgement (see below), with the same prefix and idents as the AHYD. If bit AD = 0 in the AHYD message, the unit shall respond in the slot following the AHYD address codeword; if bit AD = 1, a data codeword is appended (containing the calling address) and the unit shall respond in the slot following the data codeword. For timing on a 1200 bit/s data channel, see 6.2.1.3.

A) Incoming standard data call : IDENT2 not equal to DUMMYI

The unit shall send one of the following acknowledgements:

ACKX (QUAL=0) if it is not equipped to accept standard data calls from this calling party.

ACKX (QUAL=1) if it cannot accept this standard data call at this time (e.g. it cannot process concurrent calls or its data store is full or interaction has been requested but is not immediately possible).

ACKV (QUAL=1) if it does not support one or more of the requested facilities, i.e. does not support HADT or interaction or cannot accept the wanted PORT.

ACKB (QUAL=1) if AD = 1 in the AHYD message but the appended data codeword was not decodeable and the unit requires the message to be retransmitted.

ACK (QUAL=0) if it is available for a standard data call of this type; i.e. it can support the particular parameter settings of the AHYD. In this case, the unit shall set bit MODEM to the value appropriate for that channel; see 5.5.2.2.

The unit may indicate to its user the caller (by reference to PFIX/IDENT2 from the AHYD message or PFIX2/IDENT2 from the data codeword) and whether interaction is required, and whether the incoming call is an emergency call (by reference to bit E from the AHYD).

After receiving an AHYD message for an incoming individual standard data call and responding with ACK(QUAL=0), the unit shall wait for a GTT message for the call (i.e. a GTT message with PFIX/IDENT as its individual address,

bit O/R set to '0', an acceptable RATE and CHAN set to the number of this data channel), or until it assumes that the call will not take place (see 17.1.2.4.4).

If, while waiting for an incoming individual standard data call, a radio unit receives a repeat AHYD then it shall send the appropriate acknowledgement; also, for ACK(QUAL=0), it shall restart its timer TA/TDA.

B) "No-call" test availability check : IDENT2 = DUMMYI

The unit may indicate that it is not suitably equipped by sending ACKX(QUAL=0). Otherwise it shall send ACK(QUAL=0).

ACKX (QUAL=0) - The unit could not at any time accept a standard data call with the parameter settings of the AHYD.

ACK (QUAL=0) - Unit is in radio contact and could at times accept a data call with the parameter settings of the AHYD.

This availability check does not start or restart any timer.

17.1.2.4.3 Cancelling waiting state of individually called radio unit

If a radio unit on a data channel receives an AHYX message with PFIX/IDENT1 matching its individual address then it shall respond in the next slot with ACK(QUAL=1), with the same prefix and idents as the AHYX.

A radio unit that has received an AHYD message for an incoming individual standard data call (see 17.1.2.4.2A), and responded with ACK(QUAL=0), shall assume that the call will not take place if one of the following occurs:

a. It has not received a GTT message for the call at a time TDA after the last ACK(QUAL=0) it sent in response to an AHYD for the call.

b. It receives an AHYX message with the same prefix and idents as AHYD.

c. It receives an AHYD message checking its availability for a different incoming individual standard data call (i.e. bit E and/or the calling address and/or the PORT is different from the original AHYD).

The unit may indicate to the service user that the expected data call will not take place. In case c., the unit shall obey the procedures in 17.1.2.4.2A for the new call.

17.1.2.4.4 Receiving AHYD message addressed to a group or ALLI

If a radio unit on a data channel receives an AHYD message with

PFIX/IDENT1 matching any of its group addresses for this system

or IDENT1 set to the system-wide all-call ident ALLI

then it may accept the call information contained in the AHYD codeword and indicate it, but shall transmit no response. The unit may then assume that the next GTT(O/R=0) message, for this group or ALLI address and with CHAN equal to the number of this data channel, received within the following time TDA corresponds to the:

i) calling address
(PFIX/IDENT2 or PFIX2/IDENT2 from an appended data codeword)

ii) E bit

iii) PORT

announced by the AHYD message.

If the unit has not received a GTT(O/R=0) message at a time TDA after the last received AHYD for the call, or if it receives an AHYD message for a different call to this address, then it may assume that the expected call will not take place.

17.1.2.4.5 Receiving GTT message for same data channel

If a radio unit on a data channel receives a GTT message with channel number CHAN equal to the number of the data channel then it shall obey the procedure in this section. The procedure if CHAN is not equal to the number of the data channel is specified in section 17.2.6.2 (In-call transfer).

A radio unit on a data channel shall check all GTT messages it receives to see whether the channel number CHAN is equal to the number of this data channel and whether the message is addressed to it, that is, whether:

PFIX/IDENT from the GTT message matches its individual address

or PFIX/IDENT matches any of its group addresses for this system

or IDENT is the system-wide all-call ident ALLI.

If the GTT message is addressed to it, and TRANS >'0000000000', and it is able to receive on this data channel at the specified RATE, then the unit shall use the appropriate rule below to decide whether to accept the GTT:

a. If the unit is currently waiting for a transaction number for this address and bit O/R, having received a GTT message on a control channel with TRANS = '0000000000' (see 17.1.2.3.4c.), then it shall accept the GTT message as applying to that call.

b. If bit O/R is set to '1' and PFIX/IDENT from the GTT message matches its individual address, then:

- If the unit is making an emergency call RQD(E=1) and has not received ACKE(QUAL=0) or AHY(E=1), then it shall ignore the GTT.
- Otherwise, a unit making a data call RQD(E=0/1) shall accept the GTT message.

c. If bit O/R is set to '0' and PFIX/IDENT from the GTT message matches its individual address, and the unit is waiting for an incoming individual data call, having received an AHYD message and responded with ACK(QUAL=0), then it shall accept the GTT message.

d. Otherwise, the unit may accept the GTT message.

If the unit accepts the GTT message, it shall perform the following actions:

i) It shall be prepared to receive signalling for this transaction number.

ii) If bit O/R from the GTT message is set to '1', the unit shall note that it is the calling party. Otherwise it is a called party.

If the unit is a called party and is waiting for an incoming standard data call for this address (see 17.1.2.4.3 and 17.1.2.4.5) then it may take the PORT and the calling address (if fully supplied) from the AHYD message.

It may also give an indication to the service user.

17.2 Behaviour on the Data Channel

17.2.0 General

These procedures shall be obeyed by all stations on an allocated data channel. More than one data channel may be operated at a base station and radio units may be transferred between channels, for example to provide an even load sharing.

17.2.0.1 Signalling Formats

The signalling format shall conform to Sections 3.1 and 3.2 (but see transmission rate below).

The Data Channel codeword synchronisation sequence shall always be SYNT.

In addition to the 1200 bit/s standard transmission rate a network may offer or a radio unit may be equipped for a customised rate.

17.2.0.2 General behaviour of a TSC on a data channel

Every message transmitted by a TSC shall start with SYNT. Except for the first message in a transmission, SYNT shall be contained in a DCSC codeword.

The TSC shall monitor the return channel and shall be prepared to receive messages with timing according to 17.2.0.3 below.

Many messages require or invite individual response transmissions from radio units with timing according to 17.2.0.3. The TSC shall not transmit any combination of messages which could result in any of these required responses coinciding to produce channel interference.

It is not necessary to provide synchronisation between the Control Channel and the Data Channel.

17.2.0.3 General behaviour of a radio unit on a data channel

Whilst on a data channel a radio unit shall not indicate to its user or any attached equipment any information relating to the address or data codewords of any message except those pertinent to that radio unit. However, the radio unit itself may use the information in non-pertinent address codewords to enhance its performance, e.g. to save energy or optimise random access.

A radio unit may support more than one concurrent standard data call.

A radio unit shall start a system dependant timer, TDX or TDN, for an individual or group call respectively, for the TRANS when it receives the GTT message. Timer TDX shall be restarted whenever the radio unit receives any message relevant to the TRANS except DAHYX. If timer TDX or TDN expires the radio unit shall deem the TRANS to be closed.

If at any time a radio unit deems that it no longer has any open TRANS it shall leave the data channel and return to control channel acquisition procedures.

A radio unit shall attempt to decode DCSC codewords whilst receiving on the forward data channel. If a time TDL elapses without being able to decode any DCSC codeword the radio unit shall assume that it is out of range and shall enter channel acquisition procedures.

A radio unit shall not transmit on the return channel unless it is either to make random access within an appropriate random access frame in an unwithdrawn slot or is invited to transmit on an individual basis, which latter opportunity may be specified by either the radio unit's individual address or an individual TRANS (see below).

Every message transmitted by a radio unit shall start with SYNT. Radio unit transmission timing shall conform either to the requirements of 6.2.1.3 but with timing starting from the end of the last codeword of any invoking message from the TSC or to the timing rules specified for the particular customised transmission rate for that data call (see Appendix 6).

17.2.1 Random Access Protocol for the Data Channel

A Random Access protocol is used on the data channel which is based on that found on the control channel but differing considerably in detail.

Random access on a data channel is used by radio units to:

a) query an unexpected delay in user data transfer, or

b) send expedited data such as RESET, or

c) close one or all of its TRANS, or

d) attempt to set up a concurrent call.

17.2.1.1 TSC Random Access Facilities

17.2.1.1.1 Marking Random Access Frames

The TSC shall designate sections of a return data channel as random access frames, each containing a whole number of timeslots. Every frame is marked by a codeword which contains an Aloha submessage and an ND parameter indicating the frame size.

The zero aloha number (ND=0) is a special value indicating "this is not the beginning of a frame". Filler messages each consisting of a DCSC codeword and a codeword containing an aloha submessage with ND='0' may be used.

17.2.1.1.2 Addressing the radio unit population

The TSC may invite random access responses from all radio units, or may restrict access to a specific individual or group of units using the TRANS parameter in the data-aloha codeword.

For TRANS='0000000000', there is no restriction, i.e. all radio units may attempt access subject to the other random access rules specified in this section. For all other values of TRANS, access is restricted to the one or more units corresponding to that TRANS. This will typically be used for a group TRANS to restrict a frame for use by one particular group only. Note that unlike the control channel random access mechanism, a response is never demanded, even when an individual TRANS is specified.

17.2.1.1.3 Inviting specific types of random access message

The TSC may limit random access to particular types of message by means of specific data-aloha submessages: DAL, DALG, DALN (see 5.8.2.).

17.2.1.1.4 TSC responses

After receiving a random access message, the TSC shall send a response; valid responses are specified in the sections detailing the call procedures. The response may be sent in the slot following the random access message or it may be delayed. The TSC shall specify, using the WF field in the data-aloha submessage, the number of frames that a radio unit must wait for before attempting a further random access transmission of the message (see 17.2.1.2.6).

17.2.1.1.5 Withdrawing slots from frames

The TSC shall ensure that slot synchronism is maintained within any random access frame, e.g. at 1200 bit/s if an AHYD message within the frame contains an appended data codeword the TSC shall add an appropriate filler data codeword.

The only invoking messages the TSC may transmit within the random access frames are:

- DAHYX, DAHYZ, DAHY, AHYD, and AHYC

(Random access is inhibited in the first following return slot after the messages.)

- SITH (individual or group) such that the user data message extends at least to the end of the return channel random access frame.

17.2.1.2 Radio Unit Random Access Protocol

These procedures shall be obeyed by all radio units that are required to attempt random access on the data channel.

The various criteria given below must all be satisfied before a random access transmission is made.

17.2.1.2.1 Checking for TRANS restriction

A radio unit is permitted to transmit a non-emergency random access message only if the related transaction is invited by the TSC, by means of the TRANS parameter in the data-aloha submessage. Thus access is permitted by the radio unit if either

- RTRANS = '0000000000', or
- The specified RTRANS in the data-aloha submessage matches any of the radio unit's currently active TRANS' to be transmitted.

An emergency request, RQD(E=1), can be transmitted regardless of any TRANS restrictions.

17.2.1.2.2 Checking the Aloha function

A radio unit shall note the function from each data-aloha submessage it receives. The requests invited (subject to other restrictions) by each function are as follows:

DAL invites DRQX, DRQZ, DRUGI, DRQG, RQD(E=1), RQD(E=0), RQX

DALG invites DRQG, RQD(E=1)

DALN invites DRQX, DRQZ, DRUGI, RQD(E=1), RQD(E=0), RQX

17.2.1.2.3 Frames defined by Aloha numbers

The number of slots in a frame is equal to the aloha number within the frame marking data-aloha submessage, and can take any value in the range 1-31.

The radio unit shall monitor the forward data channel and shall note which sections of the return data channel are designated as random access frames. The first access slot in a frame starts at the end of a codeword containing a data aloha submessage with a non-zero aloha number, and respective coincidence is maintained for subsequent slots.

17.2.1.2.4 Choosing a slot from a new frame

A radio unit that requires to select a slot from a new frame shall wait for a message marking a frame available for it to use; it shall then choose a slot randomly from the specified frame length, using a uniform distribution. The unit shall transmit its message in the chosen slot, provided that the slot
is not withdrawn (see 17.2.1.2.5). For access timing see section 6.2.1.3 or as specified for the customised rate in use.

A radio unit shall not chose more than one slot from a frame.

17.2.1.2.5 Check for withdrawn slot

Before transmitting its random access message in a chosen slot, except for case (a) below, a radio unit shall check whether the slot is still available for random access by attempting to decode the final codeword in the slot immediately preceding the chosen slot. If any of the following is received then random access is permitted:

a) reception of a SITH address codeword as the last codeword in any slot of that frame before the chosen access slot, and

b) any address codeword containing an Aloha number DN, and RTRANS = '0000000000' or any currently active TRANS for this RU, and

c) the following address codewords:

AHYD or AHYC, either only with AD = '1'
(unless the AHYD or AHYC is addressed to the unit)

GTT

Note that, unless covered by rule (a), all received codewords which are spare, reserved or undecodeable do not permit random access in the next slot.

17.2.1.2.6 Noting the response delay

A radio unit shall note the delay parameter WF from each data-aloha submessage it receives.

If a random access attempt has not been acknowledged (see 17.2.2 for listed acknowledgements) before WF frames have been received, then the random access attempt may be repeated if the time-out or allowable number of tries permits.

17.2.1.2.7 Retry decision and time-outs

After sending a random access message, a radio unit shall wait to receive a response from the TSC. Various messages shall be accepted as a valid response (as specified in the sections detailing the call procedures and summarised in 17.2.2).

If the radio unit does not receive a response before WF subsequent frames have been received, it shall assume that the message was unsuccessful.

Then it shall either:

a. abandon its access attempt (see below), or

b. attempt a further random access transmission. However, if the unit receives a valid response before sending a repeat message, it shall accept the response and not retransmit.

The radio unit shall abandon its access attempt if it has sent the maximum permitted number of transmissions, NDR, and received no valid response.

The unit shall also operate a time-out, TDC, on the maximum time it spends trying to achieve access, and abandon the attempt if this time-out expires.

If the unit's access attempt to close all its TRANS fails then it shall deem them all to be closed and shall relinquish the data channel and attempt to return to the control channel. If the unit's access attempt to progress or close one TRANS {see 17.2.1 (a, b, or c)} fails then it shall deem the TRANS to be closed. If the attempt to set up a concurrent call fails then it shall abandon the attempt.

17.2.2. Messages, Submessages, and Responses on the data channel

Data channel procedures are ranked from highest to lowest as:

a) closure of all or one TRANS,
b) transfer to another data channel,
c) transfer of expedited data, and
d) transfer of user data and call set-up.

A current procedure of one rank may be interrupted or aborted by the TSC or radio unit at any opportunity by using an appropriate message to enter a procedure of a higher rank.

This subsection lists all the various messages and submessages that can be transmitted on a data channel, together with the appropriate responses in their ranking order. Descriptions of the messages are found in section 5, and their uses follow from this. A Submessage is preceded by "(S)".

All random access attempts are subject to the time-outs and re-try limits given in 17.2.1.2.7. Additionally some random access attempts are prohibited before time-outs have expired; and these accesses are marked "(L)"

All messages from the TSC are to individual radio units except those specifically indicated for groups.

LIST OF MESSAGES, SUBMESSAGES AND RESPONSES

Message	Receiver	Response(s)
CLEAR	RU	None, but deem all TRANS closed.
RQD	TSC	See 17.1
AHYD	RU	" "
AHYC	RU	SAMIS Extended address message
GTT	RU	No transmitted response. See 17.1 and 17.2.6
DRUGI (TNITEL < 63)	TSC	DAHYX, DAHYZ, (S)GO
DRUGI (RNITEL < 63)	TSC	DAHYX, DAHYZ, DACKD(REASON='001'), SITH
DRUGI(T'L =R'L = 63)	TSC	DAHYX, DAHYZ, None (await developments)
DRQG	TSC	Ignore, DAHYX (GROUP), SITH group
DRQZ	TSC	DAHYX, DACKZ
DRQX	TSC	DACKD(REASON='000)
DAHY	RU	DRQX, DRQZ(REASON='000), DRUGI
DAHYZ	RU	DRQX, DACKZ
DAHYX (TRANS > 0)	RU	DACKD(REASON = '000')
(S)DAL	RU	DRQX, DRQZ, RQD, DRQG, DRUGI, RLA (L)
(S)DALG	RU	DRQX, DRQG, RQD(E='1')
(S)DALN	RU	DRQX, DRQZ, RQD, DRUGI, RLA (L)
(S)GO after (S)DACK	RU	DRQX, DRQZ, DACKD(REASON = '001'), SITH
(S)GO (no (S)DACK)	RU	DRQX, DRQZ, RLA
(S)GO (+ (S)DACK)	TSC	DAHYX, DAHYZ, DACKD(REASON = '001'), SITH
SACK	Either	DAHYX or DRQX, DAHYZ or DRQZ, SITH
SACK (incomplete)	Either	DAHYX or DRQX, DAHYZ or DRQZ, RLA
RLA	Either	DAHYX or DRQX, DAHYZ or DRQZ, (S)DACK(P/N), and SACK
SITH	Either	DAHYX or DRQX, DAHYZ or DRQZ, (S)DACK(P/N), and SACK

17.2.3 Transmission and correction of user's data

In this sub-section there are major differences between the actions required of a station sending user data and one receiving it. These stations are referred to as data sending and data receiving stations (DSS and DRS) respectively. There are only minor differences between the actions to be taken by TSCs and radio units. For this reason, except where noted the procedures described here apply to both TSCs and radio units, although each shall always conform to the appropriate transmission timing requirements.

Due to the bidirectional facilities provided by this standard a data sending station may also be a data receiving station at the same time. Such a station shall conform to the appropriate procedures according to the particular direction of data transmission under immediate consideration at any instant.

All the procedures specified here shall be understood to refer only to the one TRANS under consideration. Every message not bearing that TRANS in its appropriate field(s) shall be deemed irrelevant. Every TRANS being processed by any station shall be treated as a separate entity, and interleaving of messages relevant to various radio units and TRANS may take place. Such interleaving is not mentioned further in this section.

17.2.3.1 Procedures for Data Sending Stations (DSS)

17.2.3.1.0 Tmessages and dataitems

User data consists of one or more Tmessages. A Tmessage consists of one or more dataitems. No dataitem shall contain data from more than one Tmessage. The last dataitem of one Tmessage may be adjacent to the first dataitem of a following Tmessage. See 17.2.3.1.4.1 for use of the MORE bit for marking the end of a Tmessage.

17.2.3.1.1 Sending a User Data Message to a Group

A group link may convey only one Tmessage in a single dataitem which may not include more user data (including any HADT checksum) than that which can be accommodated in the user data field of its address codeword plus NG data codewords, where NG = 1, 3, 7, 15, 31, 63, 127, or 255 as prearranged.

Within the link the group dataitem may be repeated a prearranged number of times. It is permitted to transmit other messages between these dataitems providing the total time between the GTT message and the end of the last codeword of the final transmission of the dataitem does not exceed TDN seconds. For example, a message with DALG submessage bearing the group TRANS to mark a random access frame could be sent after transmission of a group message. Lack of any random access attempt in that frame might then be taken by the TSC to mean that no following repeat of the dataitem is required.

17.2.3.1.2 Maximum Length of a dataitem in an Individual Link

For an individual link no dataitem may include more data than that which can be accommodated in the user data field of its address codeword plus 62 data codewords. The RNITEL field in the GO submessage indicates to a DSS how much data the data receiving station (DRS) can receive. A DSS shall not transmit any quantity of user data unless the DRS has previously indicated that it can accept at least that quantity, but a lesser quantity may be sent.

17.2.3.1.3 Responding to a GO Submessage in an individual link

Upon receiving a data acknowledgement (DACK) submessage followed by a GO submessage (which may be in the same message) a DSS shall decide whether a higher ranking message (see 17.2.2) or an old or new dataitem should be sent, and if the last, what user data will compose the new dataitem (if any) which will be sent. Once a dataitem has been sent then all or parts of that data shall be repeated as required by the DRS but no other user data shall be sent until the DRS indicates by a positive submessage (PACK) that the dataitem has been completely received. If a DSS receives a data acknowledgement and GO submessage and the limit of response time is reached before it is able to send a dataitem it shall transmit a DACKD(REASON='001') message.

17.2.3.1.4 Sending Fragments in an individual link

Transmission of each dataitem shall be achieved in one or more fragments. The first fragment shall include the entire dataitem. Other fragments shall only include those parts of the dataitem for which the DRS demands repetition. The DRS may demand that the entire dataitem be repeated.

After receiving a SACK message or GO submessage, the DSS shall decide whether to send a fragment or a higher ranking message, see 17.2.2.

17.2.3.1.4.1 Setting the fields in SITH

The control fields in the fragment address codeword, SITH, shall be set as follows:

ITENUM - For each direction of user data transmission the first dataitem in a TRANS or after a reset operation shall have ITENUM = '0'. Any further dataitems in that TRANS shall have ITENUM values which alternate '1' and '0'.

MORE - shall have the value '1' for all dataitems except for the last dataitem of each Tmessage, or TRANS if the user does not divide the data into Tmessages. MORE shall be set to '0' in a group dataitem.

FRAGL - shall be set to the number of data codewords, if any, which follow SITH.

TNITEL - shall be set to indicate the maximum number of data codewords proposed for the next dataitem. Its null value is '111111' and is used if no further dataitem is immediately proposed.

LASTBIT - shall be set to indicate the codeword bit number, see 17.0.2.5, of the last bit of user data in the dataitem unless modified by the HADT coding rules, see 17.2.3.1.4.2.

In a dataitem (i.e. the initial fragment) user data shall start in the first bit of the USER DATA field and continue in bit order through this field and through any appended data codewords until all user data in the dataitem have been included. A further information bit following the last user data in the dataitem shall be a marker bit, '1'. The marker bit shall always be provided even if that requires addition of an extra data codeword. All remaining bits in the user data field of the last codeword shall be '0's unless subsequently altered by HADT coding, see below.

17.2.3.1.4.2 HADT Coding

The SITH codeword and the user data in it is not included in HADT coding.

If HADT is invoked then the last 15 bits of appended data in each dataitem shall consist of a dataitem checksum of all the other user information bits in appended data codewords in the dataitem (see Figure 17.2). The 15 bits of the checksum are calculated as follows:

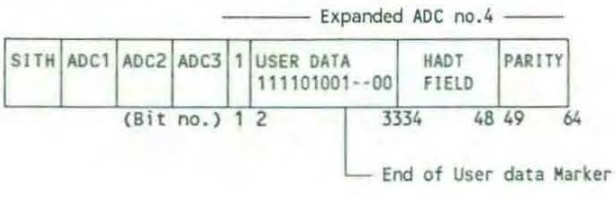
The information field of each appended data codeword containing user data or the end of data marker shall be considered to be the co-efficients of a polynomial having terms x^{61} down to x^{15}. This polynomial shall be divided modulo-2 by the generating polynomial;

$$x^{15} + x^{14} + x^{11} + x^{10} + x^9 + x^6 + x^5 + x^4 + x + 1.$$

The co-efficients of the terms x^{14} down to x^0 found at the completion of the division are termed the HADT remainder.

All the HADT remainders for the dataitem shall be modulo-2 added to form a 15-bit dataitem checksum. If bit positions 34-48 in the final user data codeword are all '0's then the dataitem checksum shall replace these '0's; otherwise a further data codeword shall be appended with bits 1-33 = '0' and the dataitem checksum shall occupy the bits 34-48 and 16 shall be added to the value of the LASTBIT field in SITH. The value in the FRAGL field of SITH shall include the added codeword.

FIG 17.2. SITH plus 4 Additional Data Codewords (ADC)



17.2.3.1.5 Actions after sending a Fragment or RLA Message

Within subsection 17.2.3.1.5 and dependant subsections the specified actions only apply if the DSS decides not to close the TRANS or send expedited data.

After sending a fragment or a "Repeat Last Acknowledgement" (RLA) message,

- a radio unit shall immediately restart its timer TDH. If no acknowledgement is received before timer TDH expires and a suitable random access frame occurs the radio unit may attempt random access with a RLA message.

- if a TSC receives a partial or no acknowledgement from the radio unit it shall either repeat the fragment or send an RLA message. The TSC shall only repeat that fragment to which it was expecting an acknowledgement.

- if a radio unit receives no acknowledgement from the TSC but receives a GO submessage it shall send an RLA message,

- if a radio unit receives a partial acknowledgement it shall send an RLA message.

17.2.3.1.5.1 After sending an RLA message

- if the acknowledgement received is the same as the last complete acknowledgement received then the DSS shall, at the next GO submessage, repeat the last fragment sent,

- if the acknowledgement received is appropriate to the last fragment sent then the DSS shall act on that acknowledgement according to the rules specified below.

17.2.3.1.5.2 After sending a fragment

- if a DSS receives a NACK submessage in acknowledgement it shall repeat the whole dataitem when it receives an appropriate GO submessage.

- if the DSS receives a SACK message in acknowledgement it shall send a fragment consisting of a SITH address codeword and ONLY the data codewords corresponding to the assigned EFLAGs set to '1' in the SACK message. This is irrespective of the setting of EFLAGs in any previous SACK message relevant to that dataitem. (If no assigned EFLAGs are set in a SACK message the DSS shall repeat the whole fragment or send an RLA message). Note that in a dataitem the user data in the SITH is repeated in all fragments of that dataitem,

- if the DSS receives a PACK submessage, it shall proceed to the next dataitem, if any. If it receives a relevant GO submessage before it has a complete Tmessage ready for transmission then it shall transmit a DACKD(REASON = '001') message.

If a DSS sends a fragment with more than 22 included data codewords or an RLA message after having last sent such a fragment it shall prepare to receive an acknowledgement with appended codeword.

17.2.3.2 Procedures for Data Receiving Stations (DRS)

17.2.3.2.1 Minimum Reception Storage when Starting a Call

A DRS shall indicate to the DSS how much data it can receive initially. Compliance with a GTT message is one method of giving this indication. Otherwise a DRS shall give the indication in the RNITEL field of a GO submessage.

For an individual link a radio unit shall disregard a GTT message unless it can receive a message with at least 22 fully used data codewords. For a group link a radio unit shall disregard a GTT message unless it can receive a message with at least a preset number, NG, of data codewords,see 17.2.3.1.1.

17.2.3.2.2 Receiving a Group Message

A radio unit which receives a SITH codeword of a group message shall count the number of times that SITH has been received within the group link, and shall also attempt to decode the message. If the group message has been repeated then amalgamation of the various decoding attempts is permitted. HADT decoding shall be used when appropriate. The radio unit shall then decide whether to accept the message, and if so it may consider the call to be complete and the TRANS to be closed. If it does not accept the message and timer TDN has not expired and the relevant SITH count is less than NDN and an appropriate random access frame is marked then the RU may attempt random access with the DRQG(TRANS=group) message to request a message repetition. If either timer TDN expires or the SITH count equals NDN then the RU shall consider the call to be complete and its TRANS closed.

17.2.3.2.3 Decoding an Individual Fragment

After decoding a SITH address codeword and attempting to decode every following data codeword in a fragment as determined by the received value of FRAGL, a DRS in an individual TRANS shall decide whether to send a higher ranking message or shall choose the appropiate acknowledgement to send. A radio unit shall also restart its timer TDE:

- if the DRS finds any inconsistency in a fragment when compared to prior states, fragments or acknowledgements, e.g. FRAGL exceeding the previous RNITEL value or an unexpected ITENUM value, etc., according to the severity or persistence of the condition it may demand closure of the TRANS or send a RESET request or request repeat of the dataitem or fragment,

- if the DRS decides to ask for the entire dataitem to be repeated it shall send a NACK submessage,

- if the DRS decides to ask for any selection of data codewords to be repeated, it shall send a SACK message.

- if the HADT mode was invoked by the call set up procedures and the entire dataitem has been decoded the DRS shall modulo-2 divide the data in each data codeword by the generator polynomial given in 17.2.3.1 above to yield HADT remainders and shall modulo-2 add these

HADT remainders together to form a dataitem checksum. If this checksum does not equal the final 15 data bits of the received dataitem then the DRS shall send a NACK message.

- if the HADT mode was invoked and LASTBIT value is larger than 48 then the last codeword contains only HADT check sum and the user data ends in the previous codeword at the point of LASTBIT-16 (see 17.2.3.1.4.2)

- if the LASTBIT value is 48 then the last additional data codeword does not contain any user data (see 17.2.3.1.4.1).

- if the DRS is satisfied that the entire dataitem can be accepted then it shall send a PACK submessage. The RNITEL field shall be set either to the value of the TNITEL field in the SITH codeword heading the accepted dataitem or to a lower value if the DRS is unable to accept that amount of data.

If the DRS receives an RLA message instead of a fragment then it shall repeat the last acknowledgement sent.

If a radio unit, after sending a GO submessage with RNITEL not equal to '111111', does not receive another relevant message before timer TDE expires and then a suitable random access frame occurs the radio unit may attempt random access with a DRUGI message.

The above-mentioned acknowledgements shall conform to the following rules:

- In a message which includes a NACK submessage, the GO submessage shall set RTRANS = ATRANS, and RNITEL to the value that was in the GO submessage which permitted that dataitem.

- A SACK message indicates that a selected codeword(s) of the dataitem is(are) required to be repeated.

[NOTE that security can be improved by ensuring that the number of EFLAGs set to '1' differs in successive SACK messages relevant to the same dataitem. Thus the value of FRAGL in the requested fragment can be related unambiguously to the number of EFLAGs set. This inequality can then be used as a further consistency test.]

- A PACK submessage informs the DSS that the dataitem has been successfully received.

In the HADT mode a DRS shall pass on only the user information to any other link or equipment.

- The GO submessage which accompanies a PACK submessage may be for any TRANS relevant to the DRS.

[Note that transmission security may be improved if this GO submessage refers to the same TRANS as that in the PACK submessage]

- A TSC may combine PACK and a Data Aloha type submessage into a single message

17.2.4 Procedures involving expedited data

17.2.4.1 DSS procedures

If a DSS receives expedited data from a preceding link or decides of its own volition to send expedited data it is preferred that it shall place that data at the head of any queue of data awaiting transmission.

If a DSS receives expedited data instead of an acknowledgement to one of its fragments it shall pass that data back to any preceding link or equipment and shall send no more data until a further message is received indicating that transmission may be resumed.

A TSC may send expedited data at any time. A radio unit may send expedited data upon receipt of a GO submessage or may send a DRQZ message in a random access frame.

If the expedited data is a RESET message then the DSS shall discard all other data queued for transmission and shall send no more data until the RESET message has been acknowledged.

17.2.4.2 DRS procedures

If a DRS receives expedited data it shall acknowledge that data and also shall pass that data on to any further link or equipment, preferably ahead of any other data.

A DRS may decide to originate expedited data for return to its corresponding DSS. A TSC may send such expedited data at any time.

A radio unit may send expedited data in place of an acknowledgement providing that the expedited data message is not longer than the replaced acknowledgement. Alternatively it may indicate by the TNITEL value in the GO part of an acknowledgement that it wishes to send data and send the expedited data when invited by a GO message. Alternatively it may send a DRQZ message in a random access frame.

If the expedited data is a RESET message then the DRS shall discard any data not yet passed on to a further link or equipment.

17.2.5 Closing a TRANS

17.2.5.1 TRANS closing procedures for a TSC

By sending a CLEAR message, a TSC may demand that all radio units close all TRANS and leave the data channel.

A TSC may close a group or System Wide link TRANS by sending a DAHYX message with IDENT = the group address or ALLI, the TRANS value to be closed, and RESP = '0'.

If a TSC receives a DRQX message for an individual TRANS with correct address then it shall send a DACKD(REASON='000') message as acknowledgement. If the address is incorrect the TSC may use DAHY to query either or both the TRANS and address.

A TSC may close all TRANS for a particular radio unit by sending a DAHYX message with PFIX and IDENT equal to the individual address of the radio unit, I/T set to '0' and the value '0000000000' in the TRANS field.

A TSC may close a particular TRANS for a radio unit by sending a DAHYX message with the TRANS value to be closed and I/T set to '1'.

A TSC may check whether a radio unit is still receiving a particular TRANS by sending the DAHY message. The acknowledgement to this message is DRUGI.

If the TSC receives no relevant messages from a radio unit for at least TDX then it shall assume that the TRANS is no longer active, and shall send a DAHYX message to close the TRANS.

A TSC may reuse the TRANS value of a closed TRANS after a period which accounts for the TRANS timer (TDX or TDN) of the radio unit(s) involved.

After closing a TRANS a TSC shall forward any data queued for transmission to any associated links.

If a TSC receives a DRQX message for a group TRANS it shall ignore it.

17.2.5.2 TRANS closing procedures for a radio unit

If its relevant timer TDX or TDN expires, a radio unit shall assume that the TRANS is closed.

By sending a DRQX message in an appropriate random access frame a radio unit may request, e.g. as a result of user action, that an individual TRANS be closed.

In response to a GO submessage or a message headed by SITH a radio unit may, by sending a DRQX message, request that an individual TRANS be closed.

If a radio unit receives a CLEAR message, or a DAHYX message with its individual address and TRANS = '0000000000', it shall close all its TRANS and leave the channel. In the case of the DAHYX message with RESP='1', it shall send a DACKD (REASON='000') acknowledgement before it leaves the data channel.

If a radio unit receives a DAHYX message with its individual address and a relevant TRANS value it shall note that the TRANS is closed. In the case of the DAHYX message with RESP='1', it shall send a DACKD (REASON='000') acknowledgement.

If a radio unit receives a DAHYX message with a group or ALLI TRANS the radio unit shall close the TRANS but not send an acknowledgement.

If a radio unit closes its last remaining TRANS then it shall leave the channel (after sending any required acknowledgement).

17.2.6 Moving a radio unit in call to another data channel

17.2.6.1 Procedures for the TSC

A TSC may NOT move radio units by using a TRANS allocated to a group link because of the risk of one or more of the radio units being engaged in a concurrent call.

17.2.6.1.1 Moving an individual radio unit

A TSC may move an individual radio unit in call to another data channel if that radio unit has only one individual TRANS. The TSC may close all but one individual TRANS for that unit to ensure this. If the TSC is a DSS it shall accomplish the move after fully receiving an acknowledgement for a fragment and before it sends the next fragment.

If the TSC is a DRS it shall accomplish the move after acknowledging a (good quality) fragment and before it sends a GO submessage for another fragment.

To accomplish an individual move a TSC shall send a GTT message with the individual address of the radio unit and the new channel designation and TRANS value to be used in the link and appropriate settings of RNITEL and TNITEL and values of O/R and RATE fields equal to those used in the original GTT for that call.

The TSC may check that the channel movement has been successful by sending a DAHY message with the new TRANS value on the new channel.

Data exchange with the radio unit shall resume at the point at which the channel change occurred.

17.2.6.1.2 Moving ALL radio units from one data channel to another

A TSC may move ALL radio units from one data channel to another. The TSC shall not attempt to do this unless all demanded or invited responses on the return channel have had time to be completed.

To accomplish this move a TSC shall send a GTT message with IDENT = ALLI, TRANS = '0000000000', O/R='0', and RATE as originally given.

17.2.6.2 Radio unit procedures

If a radio unit on a data channel receives a GTT message nominating another channel and also containing any group address it shall ignore it.

17.2.6.2.1 An Individual move

If a radio unit having only one TRANS receives an individually addressed GTT message with a new channel and a new TRANS value and all other parameters in the GTT message matching those present in the original individual GTT message it shall move to the new channel and replace the old TRANS value with the new one. The timers TDX, TDA and TDD shall continue

without being reset. Data exchange shall be expected to resume at the point at which the channel change was made.

17.2.6.2.2 An ALLI move

If a radio unit receives a GTT message with the IDENT = ALLI and TRANS = '0000000000', O/R=0 and RATE as originally given then it shall move to the designated channel and maintain its TRANS number(s) and ALL other parameters and states that existed immediately before the move message. Data exchange shall be expected to resume at the point at which the channel change was made.

APPENDIX 1

SUGGESTED VALUES FOR PARAMETERS

Parameters such as radio unit time-outs and numbers of retries are represented by symbols in this standard; for example, the maximum item duration is referred to as TT. This Appendix contains suggested values for these parameters. However, note that a radio unit must use the values required by the system on which it is currently operating.

A brief indication of the usage of each parameter is given, but readers should refer to the procedures sections for the precise definitions of usage. The table below lists the sections which refer to each parameter.

The maximum permissible tolerance for radio units implementing the times given is 10 %.

Meaning	Symbol	Suggested Value	Refs.
Number of Disconnect messages sent by individually-called radio unit.	ND1	2	9.2.3.5 9.2.3.6
Number of Disconnect messages sent by calling radio unit.	ND2	4	9.2.3.5 9.2.3.6
Maximum number of random access transmissions of RQE.	NE	16	7.3.8 10.2.1
Maximum number of traffic channel transmissions of RQS or RQX.	NI	4	11.2.1 11.2.6
Number of Pressel On messages	NPON	2	9.2.3.1
Number of Pressel Off messages	NPOFF	3	9.2.3.1
Maximum number of random access transmissions of RQS, RQD, RQX, RQT, RQR, RQQ or RQC.	NR	8	7.3.8 8.2.2.2 9.2.1.1 9.2.1.7 12.2.1 12.2.6 13.1.2.2 13.1.2.6 13.2.2.1 13.2.2.6 14.2.1 14.2.7

contd.

Meaning	Symbol	Suggested Value	Refs.
Maximum delay of TSC's response to an unsolicited message from a radio unit on a traffic channel. (The response SYNT begins not later than the start of bit NT, measured from the end of the radio unit's message.)	NT	103	6.1.2.2 6.2.2.2.2
Value of WAIT assumed at the start of a session. (WAIT is a number of slots.)	NW	4	7.3.7
Time-out for called radio unit after receiving AHY.	TA	60 seconds	9.2.2.2 9.2.2.4 13.1.2.1
Time barred from calling same ident after receiving ACK(QUAL=0), ACKX, ACKV or ACKB(QUAL=0), or any ident after receiving ACKT(QUAL=0).	TB	2 seconds	9.1.1.4 9.2.1.4 11.1.4 11.2.4 12.1.5 12.2.4 13.1.1.2 13.1.2.4 13.2.1.4 13.2.2.4 14.1.5 14.2.4
Time-out for requesting radio unit attempting random access.	TC	50 seconds	7.3.8 8.2.2.2 9.2.1.1 9.2.1.7 10.2.1 12.2.1 12.2.6 13.1.2.2 13.1.2.6 13.2.2.1 13.2.2.6 14.2.1 14.2.7
Time-out for requesting radio unit waiting for further signalling for an Include call.	TI	2 seconds	9.1.2.2 11.1.7 11.2.5

contd.

Meaning	Symbol	Suggested Value	Refs.
Time-out for requesting radio unit waiting for further signalling for a control channel transaction with the TSC (viz. registration, diversion request, or status message or short data message to the TSC).	TJ	20 seconds	7.3.8 8.2.1.3 8.2.2.4 9.1.1.7 9.2 12.1.7 12.2.5 13.1.1.4 13.1.2.5 14.1.9 14.2.6
Radio unit's inactivity time-out on a traffic channel.	TN	7 seconds	9.2.3.6
Maximum interval between periodic messages (within speech items) at the start of a session.	TP	5 seconds	9.2.2.6
Time when radio unit returns to the control channel acquisition procedures if no system identity code is decoded.	TS	5 seconds	6.2.1.2
Maximum item duration.	TT	60 seconds	9.2.3.6
Time-out for calling radio unit waiting for further signalling for a call or transaction that may require queueing (for a traffic channel or for a called party).	TW	60 seconds	7.3.8 9.1.1.7 9.1.1.10 9.2 9.2.1.6 10.1.7 10.2.7 13.2.1.7 13.2.2.5 14.1.9 14.2.6

List of Timers and Counters used for standard Data (see Section 17)

The foregoing parameters are also used for Standard Data.

Timeouts

No.	Meaning	Symbol	Range	Held By
1.	Time that a TSC may hold an undelivered Tmessage before destroying it.	TDF	System dependent	TSC
2.	Inactivity time before a TRANS is abandoned by an RU.	TDX	1, 2, 4, 8, 16, 32, 64 minutes indefinite.	TSC & RU
3.	Time that a radio unit waits waits to be allocated a TRANS after obeying GTT(TRANS=0), before returning to the control channel.	TDG		
4.	Time-out for requesting radio unit attempting random access on a data channel.	TDC	1 - 120 s	RU
5.	Time-out for requesting radio unit waiting for further signalling for a random access transaction on a data channel.	TDW	1 - 120 s	RU
6.	Time-out for called radio unit after receiving AHYD on a data channel.	TDA	1 - 120 s	RU
7.	Time-out for radio unit waiting for further data from TSC before impatiently trying DRQT.	TDE	1 - 120 s	RU
8.	Time-out for radio unit waiting for acknowledgement from TSC to data it sent before using DRQT.	TDH	1 - 120 s	RU
9.	Time barred from calling same ident on a data channel after receiving ACKV or ACKX in response to an RQD request.	TDB	1 - 60 s	RU
10.	Lack of signal timer on a standard data channel (see 17.2.0.3).	TDL	2 - 10 mins.	RU
11.	Time that a radio unit waits waits for received group data (including prearranged repeats). Started when a group GTT is received.	TDN	1 - 120 s	RU

contd.

Retry Parameters

No.	Meaning	Symbol	Range	Held By
1.	Maximum number of (non-emergency) random access transmissions on the data channel.	NDR	1 - 16	RU
2.	Maximum number of emergency i.e. RQD(E=1) random access transmissions on the data channel.	NDE	1 - 16	RU
3.	Maximum number of times that a group message will be repeated by a TSC.	NDG	1 - 16	TSC & RU

APPENDIX 2

THE ERROR CONTROL PROPERTIES OF THE CODEWORDS

The error control properties of the codewords are at least the following.

With "hard decision" decoding:

a. Detect all odd numbers of errors, any 5 random errors, and any error-burst up to length 16, or

b. correct any 1 error and detect any 4 errors and any error-burst up to length 11, or

c. correct up to any 2 errors, and detect any 3 errors and any error-burst up to length 4, or

d. correct any single error-burst up to length 5.

With "soft decision" decoding:

Correct any 5 dubious bits and any single burst of dubious bits up to length 16, according to examination of the pattern of dubious bits.

Note. The higher the degree of error correction applied, the more likely is false decoding. The application of signal quality measurement on a bit-by-bit basis may help to guard against falsing if hard decision decoding is used, and is essential if soft decision decoding is used.

APPENDIX 3

AN ALGORITHM FOR DETERMINING THE CODEWORD COMPLETION SEQUENCE OF A CONTROL CHANNEL SYSTEM CODEWORD

1. Create a codeword starting with a 16-bit preamble followed by the bit sequence '1100010011010100' and the 15-bit system identity code, thus filling bits 1 to 47.

2. Assume bit 48 = '0'. Calculate the check bits (see section 3.2.3).

3. If the parity bit = '0', then the assumption in 2 was wrong. In this case, set bit 48 = '1' and recalculate the check bits. (See also Note 1).

4. The wanted Codeword Completion Sequence is bits 48 to 63 inclusive with bit 63 inverted.

Note 1. A quick way to reverse the assumed bit and recalculate the check bits is to add modulo-2 the generator polynomial '1110100000010101' to bits 47 to 63, and then calculate the parity bit.

Note 2. The algorithm works because bits 1 to 63 are completely cyclic, except for the inversion of bit 63, and there are an odd number of '1's in the generator polynomial. The parity bit remains unaltered by any cycling process.

APPENDIX 4

AN ALGORITHM FOR GENERATING FIELDS A AND B OF THE MARK CODEWORD

1. Bits 1, 22 to 30 and 49 to 64 of the MARK address codeword are fixed (see section 5.5.4.1). Bits 2 to 5 (CHAN4) and 7 to 21 (SYS) are system-dependent. Bit 6 (field A) and bits 31 to 48 (field B) are chosen to maximise the number of bit transitions between bits 33 and 49 of the codeword.

2. In order to calculate an initial candidate MARK codeword, assume that bits 6, 31 and 32 of the MARK codeword will be '0'.

3. Obtain a 16-bit sequence to insert in bits 33 to 48 by a method similar to that in Appendix 3, i.e.

   a. Create an intermediate codeword starting with the sequence '1100010011010101', followed by CHAN4, '0' (bit 6 of MARK), SYS, '100011000' and '00' (bits 31 and 32 of MARK).

   b. Assume bit 48 of the intermediate codeword = '0'. Calculate the check bits (see section 3.2.3).

   c. If the parity bit = '0', then the assumption in b. was wrong. In this case, set bit 48 = '1' and recalculate the check bits. (See also Note 1 of Appendix 3).

   d. The 16-bit sequence to insert in bits 33 to 48 of the candidate MARK codeword is bits 48 to 63 of the intermediate codeword, with bit 63 inverted.

4. Derive seven other candidate MARK codewords having the alternative combinations of bits 6, 31 and 32. This may be performed by adding modulo-2 the following sequences to bits 33 to 48 of the initial candidate MARK codeword:

   If bit 6 = '1' add '0100000000101110'
   If bit 31 = '1' add '0111000001111110'
   If bit 32 = '1' add '0011100000111111'

5. For each candidate MARK codeword, count the number of bit transitions occurring between bits 33 and 49.

6. The required MARK codeword is a candidate which provides the greatest number of counted transitions.

APPENDIX 5

BCD CODING

Where BCD coding is specified in this standard, the following representation shall be used:

Binary value	Character represented
'0000'	0
'0001'	1
'0010'	2
'0011'	3
'0100'	4
'0101'	5
'0110'	6
'0111'	7
'1000'	8
'1001'	9
'1010'	reserved
'1011'	*
'1100'	#
'1101'	reserved
'1110'	reserved
'1111'	NULL

Note: These BCD groups shall be arranged in codewords so that the most significant bit of the binary value is transmitted first (i.e. the leftmost bit in the above table shall be transmitted first).

APPENDIX 6

Reserved for Timing of Responses for Standard Data at a customised rate

APPENDIX 7

OTHER IDEAS CONSIDERED DURING THE DRAFTING OF SECTION 17 (STANDARD DATA)

1. As explained in section 17, the Standard Data protocol is an optional feature of MPT 1327. In considering whether to implement it, firms might therefore like to be aware of other ideas which arose in the drafting discussions but were not specifically used in the protocol.

2. The ideas set out below are believed by their originators to be already in the public domain or, with their agreement , are hereby offered to it. Before proceeding, however, firms are advised to make appropriate enquiries through their Patent Agents so as to ensure that any relevant IPR claims not compromised.

3. The ideas are:

a) An "ackvitation", ie a message sent by a TSC to a radio unit, the ackvitation message being a combination of an acknowledgement to a user data message sent by the radio unit and an invitation to the same unit to send more data or repeat the data previously sent according to the requirements of the acknowledgement, see STDWP CP 623. This latter part of the message can include a parameter stating the maximum amount of data which may be transmitted next. An essential point of an ackviatation is that it needs only one address label because only one radio unit is being addressed. An example of an ackvitation is the selective acknowledgement message, "SACK".

   The "DACK" acknowledgement messages included in the standard are not ackvitations because they contain two addresses, one for the acknowledgement submessage and one for the GO submessage. If both addresses are the same then the function of the DACK message is indistinguishable from that of an ackvitation.

b) Inclusion of repeated data and new data in a single message, STDWP CP 629. Each user data message is responded to in the manner described in the text. Whereas in the text, if selective repeats are required only the repeated data is then sent by DSS in a new message, in this idea the repeated data occupies the front part of the new message and new data then is appended to the repeated data. The DRS can distinguish the repeated data from the new data by referring to the last acknowledgement it sent which, of necessity, includes the number of codewords to be repeated. The DRS has to keep a running record of the position or order of every codeword it requires to be repeated until that codeword has been successfully received.

c) Inclusion of the SYStem identity code in each message header as a means of combatting radio over-reach. The idea was extended to include either the SYS or radio unit address modulo-2 added into every user data codeword. However, it was judged that the incidence of the problem is too low to warrant inclusion of the idea.

d) Distinguishing Dataitems by length rather than by label.
STDWP CP 650

The idea here is to use a separate label for each segment, but instead to differentiate between them by their lengths. For example the length might alternate between adjacent segments or might progressively increase or decrease over the whole Tmessage. Thus each header only need include the name of the Tmessage (or TRANS). The message length could be indicated in any known manner, eg by a FRAGL field or a continuation bit in each codeword. The only requirement is that adjacent messages have different lengths unless the whole message is repeated. This serves to distinguish new messages from repeated ones, which is the only absolute necessity.

The method in the standard is to use a separate segment label but restrict this to only one bit (ITENUM). However, the length differentiation method is noted in 17.2.3.2.3 as a means of increasing security, although in this case the length is controlled by the DRS varying the number of assigned EFLAGs set.

e) To include both a message header and a message tail codeword.

A problem with reception is that if the header cannot be decoded then the whole of the user data message is lost. If a tail codeword containing substantially the same information as the header is added to the message then a DRS could record any data codewords received without a decodeable header in the hope that the tail codeword might then be decoded and hence perhaps make the received data codewords usable.

A multipath fading simulation study indicated that there could be an increase in air-time efficiency in very poor reception conditions but a decrease in efficiency in most other conditions. The latter outweighed the advantage given by the former.