

With bit 1 of the SYS field set to '1':

SYS bit no.	1	2-3	4-12	13-15
	1	NET	NDD	LAB

NET - Network operator identity

- '00' National network no. 1
- '01' National network no. 2
- '10' Reserved
- '11' Reserved

NDD - Network dependent data
(see below)

LAB - Label for multiple control channels
(see 9.5.3)

Format of the network dependent data

The network operator is free to utilise the network dependent data sub-field in any way which conforms to the following general structure and requirements:

Bit no. 9 12 SYS bit no. 1 = '0'

ZONE		FREE
AREA		
SIL		
PREFERRED NDD		

bit no. 4 12 SYS bit no. 1 = '1'

ZONE - A sub-field with length set by the network operator, starting at bit 9 (SYS bit no. 1 = '0') or bit 4 (SYS bit no. 1 = '1') which indicates the subscription zone to which the system identity code belongs.

AREA - A sub-field with length set by the network operator, starting at bit 9 (SYS bit no. 1 = '0') or bit 4 (SYS bit no. 1 = '1') which indicates the registration area to which the system identity code belongs.

FREE - A sub-field with length set by the network operator ending at bit 12 of the SYS field which may be used for any control channel identification purpose which the network operator specifies.

SIL - A sub-field with length set by the network operator (minimum 3), starting at bit 9 (SYS bit no. 1 = '0') or bit 4 (SYS bit no. 1 = '1') which indicates the sub-field to be used when checking the source of MAINT or CLEAR messages (see 11.9.2.3.3, 11.9.2.3.7 and 11.9.2.3.8).

PREFERRED

NDD - A sub-field with length set by the network operator starting at bit 9 (SYS bit no. 1 = '0') or bit 4 (SYS bit no. 1 = '1') which indicates the sub-field of the network dependent data which is to be preferred during hunting.

Zero bits is a valid length of any sub-field, in which case that sub-field has no relevance to acquisition authorisation or hunting procedures.

9.3.4.2.3 Acquisition Authorisation Data and NDD Preference Data

The radio unit shall provide facilities for acquisition authorisation data to be implanted during network personalisation to enable the radio unit to carry out the verification process specified in 9.3.4.2.1 for each possible selected network (see 9.2). This acquisition authorisation data shall consist of the following information for each possible selected network:

- the length of the ZONE sub-field (LZ),
- the length of the AREA sub-field (LA).

In addition, the acquisition authorisation storage shall provide for any combination of the following three classes of acquisition data for at least eight total entries:

- zone identity: a binary number of length equal to LZ, which authorises acquisition of control channels conveying system identity codes bearing that zone value;
- area identity: a binary number of length equal to LA, which authorises acquisition of control channels conveying system identity codes bearing that area value;
- full identity: a binary number of length 4 bits (SYS bit no. 1 = '0') or 9 bits (SYS bit no. 1 = '1') which authorises acquisition of control channels conveying the single identity code in the network which bears that value in bits 9 to 12 (SYS bit no. 1 = '0') or bits 4 to 12 (SYS bit no. 1 = '1').

Each zone, area or full identity entry in memory shall include an identifier to distinguish the three classes of data (the form to be taken by this identifier is not specified).

The radio unit may provide facilities for NDD preference data to be implanted during network personalisation to enable the radio unit to carry out the verification process specified

in 9.3.4.2.7 for each possible selected network (see 9.2). This NDD preference data shall consist of the following information for each possible selected network:

- At least four values of PREFERRED NDD sub-field, each value referred to as a preferred NDD sub-set, which identify preferred system identity codes as ones bearing these values in the PREFERRED NDD sub-field.
- For each preferred NDD sub-set a number from 0-9 indicating the length of the PREFERRED NDD sub-field in bits to which the value refers.
- For each preferred NDD sub-set, a number from 1 to 10, inclusive, indicating the order of priority (1 is highest priority, 10 lowest) in a "preferential NDD sub-set hunt stage", "preferential sampled hunt stage" or "background search sequence". The same priority may apply to more than one preferred NDD sub-set.

9.3.4.2.4 Use of Acquisition Authorisation Data

The radio unit shall apply the following procedures when checking a system identity code selected for verification against its acquisition authorisation data for the selected network.

If bit 1 of the selected SYS is '1', the mobile shall check that the selected network is a national network and that a match exists between the NET field in the selected SYS and that authorised for the selected network.

If bit 1 of the received SYS is '0', the mobile shall check that the selected network is a regional network and that a match exists between the OPID field in the selected SYS and that authorised for the selected network.

- If the radio unit holds no data for zone, area or full identity acquisition authorisation for the selected network, then it may acquire any control channel belonging to that network.
- If the radio holds data for zone, area or full identity acquisition authorisation for the selected network, then the following precedence shall apply:
 - (a) The radio unit shall first check for a match between any zone identity acquisition authorisation data and the selected system identity code. If a match is found then acquisition is authorised.
 - (b) Failing acquisition authorisation at the zone identity level, the radio unit shall check for a match between any area identity acquisition authorisation data and the selected system identity code. If a match is found then acquisition is authorised.
 - (c) Failing acquisition authorisation at the zone or area identity level, the radio unit shall check for a match between any full identity acquisition authorisation data and the selected system identity code. If a match is found

then acquisition is authorised.

If acquisition authorisation testing fails at all three levels, then the radio unit shall assume that it is not authorised to acquire the control channel under test.

9.3.4.2.5 Checking the LAB Sub-field

If the radio unit has successfully verified the system identity code against its acquisition authorisation data for the selected network it shall examine the LAB sub-field in the light of its control category held in read-only memory (see 9.2).

If the control category of the radio unit is not one of the categories permitted access by the LAB sub-field value (see 9.5.3), then the radio unit shall assume that it is not authorised to acquire the control channel under test.

9.3.4.2.6 Checking the AREA Sub-field

If the radio unit has successfully verified the system identity code against its acquisition authorisation data for the selected network and has verified that it is permitted to acquire by the value of the LAB field, then it shall examine the AREA sub-field in the light of currently-valid records of successful and denied registrations applicable to the selected network held in its read/write memory (see 9.2).

If the value of the AREA sub-field under examination is a value held in a currently-valid record of denied registrations applicable to the selected network, then a radio unit shall assume that it is not authorised to acquire the control channel under test.

In addition, if the control channel confirmation is being carried out during a "preferential area hunt stage" and if the value of the AREA sub-field under examination is not held in a currently-valid successful registration record for the selected network in the radio unit's read/write memory, then the radio unit shall assume that it is not authorised to acquire the control channel under test.

9.3.4.2.7 Checking the PREFERRED NDD Sub-field

If control channel confirmation is being carried out during a "preferential NDD sub-set hunt stage", or, where specified, during a "preferential sampled hunt stage" (see 9.3.3.3.2), the radio unit shall examine the PREFERRED NDD sub-field of the system identity code being verified against the NDD preference data for the selected network held in the radio units read-only memory. If no match can be found between any item of NDD preference data and the selected system identity code then the radio unit shall assume that it is not authorised to acquire the control channel under test on this basis.

9.3.4.3 Error Checking on a Control Channel

Whilst receiving a control channel a radio unit shall monitor the codeword error rate and count the codewords received with errors (after the application of any error corrections procedures which may be adopted) in successive samples of NC1 or NC2 codewords (values

are network dependent). Samples of length NC1 codewords shall be taken when monitoring the channel for the purpose of final checking prior to confirmation (9.3.4.4) and of length NC2 after confirmation.

In this context a "codeword" shall be considered as the contents of the first or second half of a slot on the forward control channel (see !!3.3.3.1!!) irrespective of the contents of that slot. Any codeword which is not decodable shall be regarded as a codeword with errors.

The radio unit shall also count as codewords with errors all codewords received between the first control channel system codeword with a value of SYS field different to that selected for verification and the first control channel system codeword with the value of SYS field the same as that selected for verification, including the initial control channel system codeword with the different value of SYS field.

If, in any sample of NC1 codewords, the count of codewords received with errors exceeds NX1 (network dependent), or in any sample of NC2 codewords, the count of codewords received with errors exceeds NX2 (network dependent), then a codeword sample error event shall be recorded by the radio unit. The radio unit shall hold two alternative values of NC1/NX1 and NC2/NX2 as follows:

- one set of values of NC1 and NX1 shall be utilised when monitoring a channel for the purpose of final checking prior to confirmation when the channel number is identified as one on which time-shared control channels may be expected in the store of channel numbers held in the radio unit's read-only memory as applicable to a "normal hunting sequence" (see 9.2.1) or in the store of data received from BCAST messages held in read/write memory (see 9.2.2) or in the TSI field of a received MOVE or CLEAR message;
- the other set of values of NC1 and NX1 shall be utilised when monitoring a channel for the purpose of final checking prior to confirmation when the channel number is not identified in the data stores or fields specified above as one on which time-shared control channels may be expected;
- one set of values of NC2 and NX2 shall be utilised when monitoring a channel after confirmation when the channel number is identified as one on which time-shared control channels may be expected in the store of channel numbers held in the radio unit's read-only memory as applicable to a "normal hunting sequence" (see 9.2.1) or in the store of data received from BCAST messages held in read/write memory (see 9.2.2), or in the TSI field of a received MOVE or CLEAR message;
- the other set of values of NC2 and NX2 shall be utilised when monitoring a channel after confirmation when the channel number is not identified in the data stores or fields specified above as one on which time-shared control channels may be expected.

Whilst waiting for signalling on a control channel (eg, after transmitting a random access message) a radio unit shall suspend the count of codewords received with errors. Any count

in progress at the time that a radio unit enters this waiting state shall be aborted and the result discarded.

When a radio unit leaves the control channel as a result of the circumstances specified in 9.4.1 parts (b), (c), (d), (f), (g), or (m), or (h) when due to a demanded registration, it shall resume error checking. When it acquires and verifies a new channel it shall confirm the channel (9.3.4.4) and shall then suspend error checking until it is no longer waiting for signalling.

9.3.4.4 Final Checking Prior to Access

If a control channel, which satisfies the procedures of 9.3.4.1 and 9.3.4.2, was sampled during a hunt at a level less than L.2., then it shall not be finally confirmed until the error checking procedure specified in 9.3.4.3 has produced NZ1 samples of NC1 codewords. Further if any of the NZ1 samples of NC1 codewords has produced a codeword sample error event then the radio unit shall reject the channel and resume hunting.

When a sampled control channel has passed all the appropriate tests in 9.3.4.1, 9.3.4.2 and 9.3.4.3 then the radio unit shall regard the current hunting sequence as complete and shall consider the control channel as confirmed.

9.4 Leaving a Control Channel

9.4.1 Reasons for Leaving a Control Channel Whilst Not Waiting for Signalling

Whilst active on a control channel, either prior to acquisition being confirmed or during activity subsequent to control channel confirmation, the radio unit shall monitor conditions on that channel and be prepared to leave the control channel and return to the control channel hunting procedures. This monitoring shall continue when the radio unit is waiting for signalling from the TSC, but the circumstances which result in the radio unit leaving the control channel are reduced and are prescribed in 9.4.2 below.

When not in the state of waiting for signalling from the TSC the radio unit shall leave the current control channel and enter the control channel hunting stage prescribed when:

(a) After confirmation, a codeword sample error event has been recorded in a sample of NC2 codewords (see 9.3.4.3) and codeword sample error events are recorded in each of NZ2 further successive samples of NC2 codewords. In this case the radio unit shall enter the "preferential hunt sequence".

(b) The value of bits 1 to 12 of the SYS recovered from decodable control channel system codewords received differs from the value of the bits verified during acquisition authorisation (see 9.3.4.2.1) for a continuous period TS and the next decodable control channel system codeword received after the expiry of TS also yields a value of SYS different to the verified value (see !!6.2.1.2!!). The radio unit shall remain active on the channel after the first mismatch but shall not transmit any random access message until a valid SYS value has been received, in which case it may resume normal operation (see !!6.2.1.2!!). After leaving a control channel in

these circumstances, the radio unit shall enter the "preferential hunt sequence", unless it is prior to confirmation when it shall resume hunting procedures.

(c) No decodable control channel system codewords are received over a continuous period in excess of TS (see !!6.2.1.2!!). In this case the radio unit shall enter the "preferential hunt sequence", unless it is prior to confirmation when it shall resume hunting procedures.

(d) An Aloha or, in the case of radio units which are equipped to employ the MARK message, a MARK message is received in which the value of CHAN4 does not match the least significant four bits of the channel number of the control channel and there is also no match in the next decodable Aloha or MARK message. The radio unit shall remain active on the channel after the first mismatch but shall not transmit any random access message and shall leave the channel immediately after the second mismatch, unless a valid CHAN4 value has been received in the interim in which case it may resume normal operation (see !!6.2.1.2!!). After leaving a control channel in these circumstances the radio unit shall enter the "preferential hunt sequence", unless it is prior to confirmation when it shall resume hunting procedures.

(e) The user initiates a change of selected network. In this case the radio unit shall assume control channel acquisition procedures on the new selected network with the "single channel hunt sequence", the "preferential hunt sequence", or the "normal hunt sequence" depending on what valid information of previous activity on the new selected network is held in the radio unit's read/write memory.

(f) A MOVE message applicable to the radio unit is received (see !!7.4.2!!). In this case the radio unit shall note the value of the TSI field and enter either the "single channel hunt sequence" or the "preferential hunt sequence" depending on the value of the CONT field in the MOVE message, unless it is prior to confirmation when it shall resume hunting procedures.

(g) A control channel system codeword is received in which the value of the LAB sub-field in the system identity code indicates that the control category of the radio unit for the selected network is not permitted access on the current control channel and the LAB value in the next decodable control channel system codeword also indicates that the radio units control category is not acceptable. The radio unit shall remain active on the channel after the first failure but shall not transmit any random access message and shall leave the channel immediately after the second failure, unless a value of LAB sub-field is received in the interim which does permit access by the unit, in which case it may resume normal operation (see 9.5.3). After leaving a control channel in these circumstances the radio unit shall enter the "preferential hunt sequence", unless it is prior to confirmation when it shall resume hunting procedures.

(h) The radio unit receives ACKX(QUAL='0') as a result of sending a random access registration (RQR) message (see !!8.2.2.3!!), or as a response to an RQR sent in reply to a registration demand by the TSC (see !!8.3.2.2!!). In the case of a random access registration request (not permitted prior to confirmation) or a

registration demand received whilst the radio unit is seeking to make a random access registration request, the radio unit shall assume the hunt stage that it was last engaged in prior to the registration attempt. It may either resume the hunt stage at the channel number it would have sampled next or commence the hunt stage anew. In the case where a registration demand was received at any other time, the radio unit shall enter the "preferential hunt stage", unless it is prior to confirmation when it shall resume hunting procedures.

(j) After confirmation, the radio unit receives ACKX(QUAL='1') as a result of sending a random access registration request (RQR) message (see !!8.2.2.3!!). In this case the radio unit shall assume the hunt stage that it was last engaged in prior to the registration attempt. It may either resume the hunt stage at the channel number it would have sampled next or commence the hunt stage anew.

(k) After confirmation, the radio unit has timed out after a random access registration (RQR) attempt due to NR being reached or TC being exceeded (see !!7.3.8!!). In this case if the registration attempt is being carried out prior to a successful re-registration being achieved on a newly-confirmed control channel the radio unit shall assume the hunt stage that it was last engaged in prior to the registration attempt. It may either resume the hunt stage at the channel number it would have sampled next or commence the hunt stage anew. If the registration attempt is being carried out at any other time the radio unit shall enter the "preferential hunt sequence".

(l) When the radio unit receives an ALHF message or equivalent (see 13.6) and the radio unit is not in the fall-back mode (see 13.3). In this case the radio unit shall enter the "preferential hunt sequence". If the radio unit is equipped with the fall-back option it shall obey the procedures of section 13.

(m) When the radio unit receives a GTC message which it has not obeyed in which the designated traffic channel is the control channel on which the message was received and the radio unit is not in the fallback mode (see !!9.2.2.5!!). In this case the radio unit shall enter the "preferential hunt sequence".

In addition to these mandatory conditions a radio unit may leave the current control channel and enter the control acquisition procedures when:

(n) After confirmation, the radio unit receives ACKX(QUAL='1') as a result of sending a random access request message, except RQR. If the radio unit leaves the control channel as a result of exercising this option it shall enter the "preferential hunt sequence".

(p) After confirmation, the radio unit has timed-out after a random access attempt, except RQR, due to NR or NE being reached or TC being exceeded (see !!7.3.8!!). If the radio unit leaves the control channel as a result of exercising this option it shall enter the "preferential hunt sequence".

(q) After confirmation, the radio unit has identified one or more prospective

control channels as a result of carrying out a "background search sequence" (see 9.3.3.7). If the radio leaves the control channel as a result of exercising this option it shall enter the "preferential hunt sequence".

In addition a radio unit may leave the current control channel, temporarily, when:

(r) It has received a BCAST (SYSDEF = '00101') message. In this case the radio unit shall switch to the return channel indicated by the CHAN field in the message and shall return to the confirmed control channel in sufficient time to be able to decode any address codeword which may be transmitted in the forward direction in the second slot following the slot containing the BCAST (SYSDEF = '00101') message.

(s) In the course of implementing a "background search sequence" it initiates a sampling activity in accordance with the requirements of section 9.3.3.7.

9.4.2 Leaving a Control Channel Whilst Waiting for Signalling

A radio unit waiting for signalling shall leave the control channel on which it is currently active when any of the following events as listed in 9.4.1 above occur: (b), (c), (d), (f), (g), (h) due to a demanded registration, and (m). In such circumstances the radio unit shall retain its state of waiting for signalling during any hunting procedures and subsequent control channel confirmation tests. Any timers relevant to the waiting state shall be maintained.

In addition, a radio unit which times-out on the expiry of timer TJ whilst waiting for signalling relevant to the transmission of an RQR message shall:

- i. If the registration attempt is being carried out prior to a successful re-registration being achieved on a newly-confirmed control channel, assume the hunt stage that it was last engaged in prior to the registration attempt. It may either resume the hunt stage at the channel number it would have sampled next or commence the hunt stage anew.
- ii. If the registration attempt is being carried out at any other time, enter the "preferential hunt sequence".

A radio unit which enters the control channel acquisition procedures whilst in the waiting state shall obey the hunting procedures specified in 9.3.3 and the control channel confirmation procedures specified in 9.3.4. In addition, whilst in the waiting state, the radio unit shall only confirm a control channel in which the value of bits 1-12 of the system identity code (SYS) being examined under the procedure specified in 9.3.4.2 matches bits 1-12 of the system identity code which was examined to authorise acquisition of the control channel on which the radio unit was last confirmed. A radio unit which, having entered the control channel acquisition procedure whilst in the waiting state, times out on any of the timers TA, TC, TJ or TW as appropriate to its condition, shall continue to search for a control channel but shall resume the control channel acquisition procedures, but without the application of the additional SYS code check specified above.

A radio unit waiting for signalling which leaves the control channel on which it is currently active due to events (e) or (l) listed in the foregoing 9.4.1 shall cancel its waiting for signalling state upon entering the control channel acquisition procedures.

It should be noted that events (a), (h) for a random access registration request, (j), (k), (n), (p), (q), (r) and (s) are not applicable to a radio unit in the state of waiting for signalling.

9.5 Multiple Control Channels

9.5.1 Introduction

Commercial networks in Band III sub-bands 1 and 2 may operate with multiple control channels at a single site and may require the subdivision of the radio unit population to allow load sharing between control channels. This facility is provided by the LAB sub-field in the system identity code (see 9.5.3) and by control categorisation of radio units (see 9.5.2).

9.5.2 Control Categorisation of Radio Units

At the time of network personalisation the radio unit shall be allocated a control category (CCAT) and this category shall be stored in the radio unit's read-only memory. Four control categories are available, which are designated A, B, C and D for convenience.

The control category governs acquisition and retention of a control channel, since the LAB sub-field in the system identity code indicates which radio unit control categories are allowed to use a control channel (see 9.3.4.3 and 9.4).

9.5.3 The LAB Sub-field

The LAB sub-field occupies bits 13 to 15 of the system identity code (see 9.3.4.2.2). The meanings assigned to the eight possible values of LAB shall be:

'000'	Reserved (future definition in MPT 1343)
'001'	All categories permitted
'010'	Categories A and B only permitted
'011'	Categories C and D only permitted
'100'	Category A only permitted
'101'	Category B only permitted
'110'	Category C only permitted
'111'	Category D only permitted

10 **REGISTRATION**

10.1 General

10.1.1 Introduction

Registration is a method of recording the area or group of areas where a radio unit is likely to be located within a network. This information avoids searching for radio units throughout the whole network, consequently reducing call set-up time and control channel loading.

A secondary feature is that it provides a means of restricting the service of individual radio units by allowing the network to deny registration requests.

The registration strategy enables networks to operate single or multiple registration. It is mandatory for radio units to support single registration, and multiple registration is a standard option. On networks which employ multiple registration, single registration radio units may make more registration requests than multiple registration radio units. Since the single registration radio unit is registered in only one area however, it is likely that fewer AHOY messages from the network would be required to locate it. Registration strategy is determined by the network and may be broadcast to radio units to allow them to take appropriate actions.

The registration strategy describes two types of registration. The first of these is explicit registration, where registration is achieved by means of an RQR message (either random access or demanded). The second is implicit registration, appropriate to multiple registration type radio units, where registration is achieved by means of messages exchanged during call set-up. Only messages that terminate control channel signalling are used for implicit registration.

It is possible that due to a failure the network may not be able to maintain registrations, but will want radio units to use the network as if they are registered. The network may broadcast a message to indicate that a temporary registration mode is in operation. Radio units which receive this message will recognise the temporary registration mode, and may be required to re-register on receipt of a further broadcast message indicating that the network is in a normal registration mode.

10.2 Single Registration

10.2.1 Procedure

The single registration procedure specified in this section enables a network to record the likely area in which a radio unit is located.

10.2.1.1 The Principle

The principle of registration requires that the radio unit shall only retain a valid registration record where it has received confirmation that it is the same record as that currently held within the network. If there is any doubt that the record is correct, then a NULL indicator

must be written against the record. If a radio unit fails to receive a response to a registration request, this could be due to:

- the request not being received by the network, in which case the network will regard the previous successful registration by the unit as the currently-valid registration record;
- the request being accepted by the network but the acknowledgement not being received by the radio unit, in which case the network will regard the unsuccessful registration by the unit as the currently-valid registration record;
- the request being denied or failed by the network but the acknowledgement not being received by the radio unit, in which case the network may either regard the previous successful registration by the unit as the currently-valid registration record or record a NULL registration for the calling unit.

Accordingly, in such cases the radio unit is not able to confirm whether the network holds a valid record for the unit and if it does, whether it is the previous registration or the present registration. It shall therefore, when making a registration attempt, write the registration record into its memory at the time of making the registration attempt but, at the same time, write a NULL indicator against the record. When the successful registration is confirmed by a suitable acknowledgement from the system the radio unit shall then cancel the NULL indicator.

10.2.2 Storage and Timing requirements

10.2.2.1 Requirements

In order to follow the procedures specified in this section the radio unit shall provide the following storage requirements appropriate to the selected network:

a) In Type 'B' read/write memory (see section 6.2):

The registration record applicable to the selected network. The registration record shall include the value of the verified AREA code and may include the channel number of the control channel on which that explicit or implicit registration attempt was carried out. The registration record shall also include a flag to indicate whether the registration record is normal or temporary. Until the radio unit is switched off, or equivalent, the flag shall also be capable of indicating an undefined state prior to being set.

The radio unit shall discard any data held in protected read/write memory unless its validity is reasonably assured. Also it should be noted that the values described in 10.2.2.1(a) may be held in unprotected RAM while operational and transferred to protected RAM on switch off or equivalent.

The registration records used by a single registration radio unit are indicated in Table 6.1 as "Prime registration" records.

b) In read/write memory:

- i. At least 8 different values of AREA sub-field of the received system identity code verified when acquiring the control channel on which a registration attempt by the radio unit has been denied. These shall be managed as a FIFO list: when the radio unit has a full list of entries, any further addition to the list shall displace the earliest entry.
- ii. The latest value of the REG parameter received on the control channel to indicate whether the control channel is in the normal or temporary registration mode (an undefined state shall be indicated prior to receipt of REG within a session).

c) In read-only memory, which shall be set by network personalisation:

A value of the ZONE field which shall be designated as the 'home' ZONE of the radio unit.

Note: A single registration type radio unit shall ignore the NA field advised by any BCAST (SYSDEF='00011') messages successfully decoded during activity on the selected network.

10.2.2.2 Action on Switch-off or Switch-on or equivalent

Data held under 10.2.2.1 b) shall be discarded at some time between the radio unit being switched off and being made ready for service after being subsequently switched on. For these purposes a user-initiated change of selected network shall be regarded as being equivalent to switching off the radio unit.

If, at switch-off (or equivalent), the registration record is currently labelled as undefined (see sections 10.2.4.1.1, 10.2.4.2.1, 10.2.5.1.1 and 10.2.5.2.1), then at some time between the radio unit being switched off and being made ready for service after being subsequently switched on, the registration record shall be labelled as normal.

10.2.3 Action on confirmation of a control channel

A radio unit shall not make any attempt at random access until control channel confirmation has been achieved, see 9.3.4.4.

When a radio unit confirms a control channel it shall then:

- i. If the verified AREA code is zero, or the radio unit is personalised with a zero length AREA field, or the radio unit is in fall-back mode, the radio unit shall not seek to register by random access nor shall it create or alter any registration record. The radio unit shall note that registration is not required and that it is free to initiate calls.

Otherwise:

- ii. If the verified area code is in the list of denied registrations, the radio unit shall resume hunting (see section 9).

Otherwise:

- iii. If the radio unit does not hold a successful registration record for the verified AREA code, the radio unit shall attempt to register by random access (see section 10.2.4) according to normal rules (see !!7.3!!).

Otherwise:

- iv. If the radio unit holds a successful registration record for the verified AREA code it shall not attempt to register. If the radio unit is of a type which stores the relevant channel number in the registration record and, if the stored channel number is different from the current number, then the radio unit shall replace the stored channel number in the record by the current channel number without otherwise affecting the registration record.

Once confirmed on a control channel, the radio unit shall not transmit any message other than RQR, or an acknowledgement in response to an Ahoy with IDENT1 = REGI (!!8.2.2.4!!), unless it holds a successful registration record relating to the verified AREA code (unless the verified AREA code is zero, or the radio unit is personalised with a zero length AREA field, or the radio unit is in the fall-back mode). If at any time whilst active on a control channel the radio unit ceases to hold a successful registration record relating to the verified AREA code, it shall refrain from transmitting any message other than RQR, or an acknowledgement in response to an Ahoy with IDENT1 = REGI (!!8.2.2.4!!), until a successful registration record relating to the verified AREA code is held (unless the verified AREA code is zero, or the radio unit is personalised with a zero length AREA field, or the radio unit is in the fall-back mode). Whilst restricted in its transmissions due to not holding an appropriate registration record the radio unit shall obey any applicable messages received, as required, provided that to do so does not involve transmitting on the control channel (other than RQR or an ACK to an AHY with IDENT1 = REGI).

At any time that the radio unit holds a successful registration record relating to the verified AREA code, it is free to transmit any message conforming to the requirements of this specification.

10.2.4 Registration Procedures

10.2.4.1 Registration by Random Access

When a radio unit determines that it is required to register, it shall attempt to do so by random access using the procedures defined in MPT 1327 section 8.2.2. Note that if the registration is occasioned by the receipt of BCAST (SYSDEF = '00011'), then the actions prescribed in section 10.2.7 c) or d) shall be performed prior to those defined below.

If the random access timeout TC expires and the radio unit has not sent a registration request (!!8.2.2.2!!), the radio unit shall enter the control channel acquisition procedures (section 9).

Immediately upon sending the registration request by random access, the radio unit shall write into memory the AREA code for the system to which it is making the request together with a NULL indicator and delete the AREA code retained from its previous registration.

The action after transmitting a random access registration request shall be as specified in sections 10.2.4.1.1 to 10.2.4.1.5.

10.2.4.1.1 Registration accepted

The registration attempt shall be considered successful on receipt of ACK(QUAL = '0'). The radio unit shall:

- a) convert the NULL record to a successful registration record by removing the NULL indicator and
- b) if the radio unit has received a REG parameter (see 10.2.7) since commencing the session, it shall label the registration record as either normal or temporary, corresponding to the latest received value of REG. If the radio unit has not received a REG parameter (see 10.2.7) since commencing the session, it shall label the registration record as undefined (see also 10.2.2.2 and 10.2.7).

10.2.4.1.2 Registration Denied

The registration attempt shall be considered denied on receipt of ACKX(QUAL = '0'). The radio unit shall:

- a) write the AREA code in the list of denied registration records (see section 10.2.2).
and
- b) enter the control channel acquisition procedures (see section 9).

10.2.4.1.3 Registration Failed

The registration attempt shall be considered to have been unsuccessful upon receipt of ACKX(QUAL='1').

The radio unit shall resume hunting, see 9.4.1(j), and after confirming a control channel and receiving a suitable Aloha message, shall re-commence a random access registration attempt in accordance with section 8.2.2 of MPT1327.

Note that, until a successful registration is achieved, the radio unit shall not attempt to transmit other than RQR messages, or an acknowledgement in response to an Ahoy with IDENT1 = REGI (!!8.2.2.4!!), but shall continue to obey any received messages, provided that to do so does not involve transmitting on the control channel (other than RQR, or an ACK to an Ahoy with IDENT1 = REGI).

10.2.4.1.4 Registration Attempt Times Out

If the radio unit times out from waiting for further signalling for the registration (!8.2.2.4!!), or cancels its wait state as defined in section 9.4.2, it shall enter the control channel acquisition procedures (section 9).

10.2.4.1.5 Registration Demand Received During a Random Access Registration Transaction

If, while waiting for a response to a random access registration request message, the radio unit receives an ALHR message individually addressed to it, the radio unit shall send a registration request RQR in accordance with MPT 1327 section 8.3.2.1 a2 (the radio unit shall not send an emergency request RQE).

The action shall then be as defined in sections 10.2.4.1.1 to 10.2.4.1.4, and in sections 7.3 and 8.2.2.2 of MPT 1327.

10.2.4.2 Registration on Demand

If, whilst confirmed on the control channel and not attempting to register by random access, a radio unit receives an applicable individually addressed ALHR, it shall write a NULL record against the existing registration record for the currently verified AREA code and shall attempt to register, complying with the procedures defined in MPT 1327 section 8.3.2.

The radio unit action after transmitting RQR upon demand, whilst not attempting to register by random access, shall be as defined in sections 10.2.4.2.1 to 10.2.4.2.3.

10.2.4.2.1 Registration Accepted

On receipt of ACK(QUAL='0') the registration shall be considered accepted and the radio unit shall:

- a) convert the NULL record to a successful registration record by removing the NULL indicator, and
- b) if the radio unit has received a REG parameter (see 10.2.7) since commencing the session, it shall label the registration record as either normal or temporary, corresponding to the latest received value of REG. If the radio unit has not received a REG parameter (see 10.2.7) since commencing the session, it shall label the registration record as undefined (see also 10.2.2.2 and 10.2.7).

10.2.4.2.2 Registration Denied

Registration is denied if ACKX(QUAL='0') is received. On receipt of this message the radio unit shall:

- a) write the AREA code in the list of denied registration records, and

- b) enter the control channel acquisition procedures (section 9).

10.2.4.2.3 No Acknowledgement Received

If no response is received within WAIT + 1 slots, the radio unit shall make no consequential changes to its registration record. If, as a result of the action prescribed in 10.2.4.2, the radio unit has no registration record for the verified AREA code, then it shall attempt to register by random access.

10.2.5

This paragraph is not used.

10.2.6

This paragraph is not used.

10.2.7 Action on receiving broadcast registration parameters

- a) The radio unit shall not make use of the NA field.
- b) If the radio unit holds an undefined registration record for the verified AREA code, the record shall be labelled as either normal or temporary corresponding to the value of REG received.
- c) If the radio unit receives REG = '0' while active on a control channel, it shall record that the channel is in the normal registration mode.

If the radio unit holds a temporary registration record for the verified AREA code, it shall delete that record and attempt to register by random access.

- d) If the radio unit receives REG = '1' while active on a control channel, it shall record that the channel is in the temporary registration mode.

If the radio unit holds a normal registration record (not temporary) for the control channel, and the ZONE value of the verified system identity code differs from the 'home' ZONE of the radio unit, the radio unit shall label the registration record as temporary.

Note that b), c) and d) shall apply to all registration records held by the radio unit, not only the prime records.

10.2.8 Fall-back Mode

Any radio unit (whether or not it implements the fall-back mode option) which receives an ALHF message on a control channel for which the verified AREA code corresponds to a registration record, but for which the verified ZONE code does not match its home zone, shall label the registration record as temporary.

10.2.8.1 Entering Fall-back Mode

Upon entering fall-back mode (see 13.3) a radio unit shall continue to maintain registration records. Whilst in the fall-back mode and confirmed on the fall-back channel, the radio unit shall not attempt to register by random access or make use of control channel messages to implicitly register; the radio unit is free to initiate and receive calls even if the unit does not have a registration record for the verified AREA code.

10.2.8.2 Leaving Fall back Mode

Upon leaving the fall-back mode the radio unit shall attempt to register if required to by sections 10.2.3 or 10.2.7.

10.3 Multiple Registration

10.3.1 Introduction

As a radio unit travels within range of more than one registration area, it may be advisable to guard against frequent re-registration, otherwise excessive registration request signalling may be generated. The multiple registration procedure specified in this section aims to minimise this problem. It provides a mechanism whereby the radio unit may be registered in more than one area simultaneously and so can move freely between the areas for which it has valid registrations without re-registering

To minimise the number of radio units simultaneously registered in more than one area (thereby minimising the amount of Ahoy signalling), there is a time-out mechanism whereby 'old' registrations expire if the radio unit does not make any calls in the area for a specified time. The specification defines the time-out in the radio unit; the network may operate a corresponding time-out.

Although old registrations in the radio unit expire after a time-out, the most recent, or prime, registration does not expire, in order to avoid periodic re-registration.

It is important that the registration records stored in the radio unit and in the network correspond. If a radio unit believes it is registered in a particular area, but the network does not, then the radio unit will not receive any calls while in that area. Much of the specification serves to maintain this correspondence as closely as possible, despite corruption of signalling. Any discrepancy must be 'fail-safe', ie the network may hold a record of registration that the radio unit does not hold, but the radio unit must not believe that it is registered in an area that the network has not recorded.

10.3.1.1 The Principle

The multiple registration procedure is described with reference to the examples below which show, for triple registration, what happens as a radio unit travels between different registration areas.

Figure 10.3 illustrates the basic operation. Initially the radio unit is registered in area A and is in the normal registration mode. When it travels to area B it must register before accessing the network. Registration information from area A is retained both in the radio unit and the network for a time determined by the network operator. The radio unit now returns to area A and does not need to re-register. However, since B was the most recent (prime) registration area, the radio unit registration for A will time-out. In such an event the radio unit is immediately aware that it is no longer registered in the area corresponding to the control channel currently received and so attempts to register. As a result, B becomes a timed registration and will eventually time-out in the radio unit and network.

Figure 10.3 shows what happens if there is no response to a registration attempt as the radio unit travels. It will be seen that the radio unit record and the network record no longer correspond, but by inserting a null record at the radio unit no ambiguity arises. It also shows how the registration records are updated by implicit registration when the radio unit makes a call in an area for which a registration record already exists.

	Location of radio unit	A	B	A	A	A
	Radio unit action	Registers on A	Registers on B	Does not re-register	Times-out of A and registers	Times out of B
radio unit records	Prime reg record	A	B	B	A	A
	Timed reg records	NULL NULL	A NULL	A NULL	B NULL	NULL NULL
Network records	Prime reg records	A	B	B	A	A
	Timed reg records	NULL NULL	A NULL	A NULL	B NULL	NULL NULL

FIGURE 10.3 - EXAMPLE 1

	Location of radio unit	A	B	C	A	A
	Radio unit action	Registers on A	Attempts to register on B - response not received	Registers on C	Does not register	Makes a call - implicit registration on A
Radio unit records	Prime reg recorded	A	NULL	C	C	A
	Timed reg records	NULL NULL	A NULL	NULL A	NULL A	C NULL
Network records	Prime reg records	A	B	C	C	A
	Timed reg records	NULL NULL	A NULL	B A	B A	C B

FIGURE 10.3 - EXAMPLE 2

10.3.2 Storage and Timing Requirements

10.3.2.1 Requirements

In order to follow the procedures specified in this section the radio unit shall provide the following storage requirements appropriate to the selected network:

- a) In Type 'B' read/write memory (see section 6.2):
 - i. The latest value of NA (the maximum number of registration records which the radio unit shall hold concurrently) appropriate to the selected network as advised by any BCAST (SYSDEF='00011') messages successfully decoded during activity on the selected network. In the event that no valid data of the appropriate value of NA is held then the radio unit shall assume a default value of NA = 1 until such time as a BCAST (SYSDEF = '00011') message is successfully decoded from the selected network.
 - ii. The prime registration record applicable to the selected network. The registration record shall include the value of the verified AREA code (together with a NULL indicator if applicable) and may include the channel number of the control channel on which that explicit or implicit registration attempt was carried out. The registration record shall also include a flag to indicate whether the prime registration record is normal or temporary. Until the radio unit is switched off, or equivalent, the flag shall also be capable of indicating an undefined state prior to being set.

Note: The radio unit shall discard any data held in protected read/write memory unless its validity is reasonably assured. Also it should be noted that the values described in a)i, and a)ii may be held in Type 'A' memory while operational and transferred to Type 'B' memory on switch off or equivalent.

- b) In read/write memory:
 - i. (NA-1) timed registration records which, together with the prime registration record specified in a)ii above, form the NA registration records applicable to the selected network. Each record shall include the verified AREA code (together with a NULL indicator if applicable) and a flag to indicate whether the registration record is normal or temporary (the flag shall also be capable of indicating an undefined state, prior to being set). Each record may include the channel number of the control channel on which the explicit or implicit registration attempts were carried out. The radio unit shall discard any timed registration record held in read/write memory when a time TD has elapsed since the registration record was written to read/write memory.
 - ii. At least 8 different values of AREA sub-field of the received system identity code verified when acquiring the control channel on which a registration attempt by the radio unit has been denied. These shall be managed as a FIFO list: when the radio unit has a full list of entries, any further addition to the list shall displace the earliest entry.

- iii. The latest value of the REG parameter received on the control channel to indicate whether the control channel is in the normal or temporary registration mode (an undefined state shall be indicated prior to receipt of REG within a session).
- c) In read-only memory, which shall be set by network personalisation:
 - i. A value of the ZONE field which shall be designated as the 'home' ZONE of the radio unit.

10.3.2.2 Action on Switch off or Switch on or equivalent

Data held under 10.3.2.1 b) shall be discarded at some time between the radio unit being switched off and being made ready for service after being subsequently switched on. For these purposes a user-initiated change of selected network shall be regarded as being equivalent to switching off the radio unit.

If, at switch-off (or equivalent), the prime registration record is currently labelled as undefined (see sections 10.3.4.1.1, 10.3.4.2.1, 10.3.5.1.1 and 10.3.5.2.1), then at some time between the radio unit being switched off and being made ready for service after being subsequently switched on, the prime registration record shall be labelled as normal.

10.3.2.3 Value of a NULL record

A NULL record contains the AREA code and a NULL indicator.

10.3.3 Action on confirmation of a control channel

A radio unit shall not make any attempt at random access until control channel confirmation has been achieved, see 9.3.4.4.

When a radio unit confirms a control channel it shall then:

- i. If the verified AREA code is zero, or the radio unit is personalised with a zero length AREA field, or the radio unit is in fall-back mode, the radio unit shall not seek to register by random access nor shall it create or alter any registration record. The radio unit shall note that registration is not required and is free to initiate calls.

Otherwise:

- ii. If the verified area code is in the list of denied registrations, the radio unit shall resume hunting (see section 9).

Otherwise:

- iii. If the radio unit does not hold a successful registration record for the verified AREA code, the radio unit shall attempt to register by random access (see section 10.3.4) according to normal rules (see !!7.3!!).

Otherwise:

- iv. If the radio unit holds a successful registration record for the verified AREA code it shall not attempt to register. If the radio unit is of a type which stores the relevant channel number in each registration record and, if the stored channel number is different from the current number, then the radio unit shall replace the stored channel number in the record by the current channel number without otherwise affecting the registration record or associated timer.

Once confirmed on a control channel, the radio unit shall not transmit any message other than RQR, or an acknowledgement in response to an Ahoy with IDENT1 = REGI (!!8.2.2.4!!), until it holds a successful registration record relating to the verified AREA code (unless the verified AREA code is zero, or the radio unit is personalised with a zero length AREA field, or the radio unit is in the fall-back mode). If at any time whilst active on a control channel the radio unit ceases to hold a successful registration record relating to the verified AREA code, it shall refrain from transmitting any message other than RQR, or an acknowledgement in response to an Ahoy with IDENT1 = REGI (!!8.2.2.4!!), until a successful registration record relating to the verified AREA code is held (unless the verified AREA code is zero, or the radio unit is personalised with a zero length AREA field, or the radio unit is in the fall-back mode). Whilst restricted in its transmissions due to not holding an appropriate registration record the radio unit shall obey any applicable messages received, as required, provided that to do so does not involve transmitting on the control channel (other than RQR or and ACK to an AHY with IDENT1 = REGI).

At any time that the radio unit holds a successful registration record relating to the verified AREA code, it is free to transmit any message conforming to the requirements of this specification.

10.3.4 Registration Procedures

10.3.4.1 Registration by Random Access

When a radio unit determines that it is required to register, it shall attempt to do so by random access using the procedures defined in MPT 1327 section 8.2.2. Note that if the registration is occasioned by the receipt of BCAST (SYSDEF = '00011'), then the actions prescribed in section 10.3.7 c) or d) shall be performed prior to those defined below.

If the random access timeout TC expires and the radio unit has not sent a registration request (!!8.2.2.2!!), the radio unit shall enter the control channel acquisition procedures (section 9).

Provided that the prime registration record is not already a NULL containing the same AREA code as the currently verified AREA code, then immediately the radio unit transmits its first registration request message by random access it shall:

- a) change the prime registration record, whether or not it has a NULL indicator appended to it, into a timed registration record with a newly started timer, deleting, if necessary, the timed registration record closest to expiry (see section 10.3.6), and then,

- b) write into its prime registration record the AREA code for the system to which it is making the request together with a NULL indicator.

Note that the requirements of this paragraph shall not apply to repeat transmissions of the request message within the same registration attempt.

The action after transmitting a random access registration request shall be as specified in sections 10.3.4.1.1 to 10.3.4.1.5.

10.3.4.1.1 Registration Accepted

The registration attempt shall be considered successful on receipt of ACK(QUAL = '0'). The radio unit shall:

- a) convert the NULL prime record to a successful prime registration record by removing the NULL indicator, and
- b) if the radio unit has received a REG parameter (see 10.3.7) since commencing the session, it shall label the registration record as either normal or temporary, corresponding to the latest received value of REG. If the radio unit has not received a REG parameter (see 10.3.7) since commencing the session, it shall label the registration record as undefined (see also 10.3.2.2 and 10.3.7).

10.3.4.1.2 Registration Denied

The registration attempt shall be considered denied on receipt of ACKX(QUAL = '0'). The radio unit shall:

- a) write the AREA code in the list of denied registration records (see section 10.3.2), and
- b) enter the control channel acquisition procedures (see section 9).

10.3.4.1.3 Registration Failed

The registration attempt shall be considered to have been unsuccessful upon receipt of ACKX(QUAL='1').

The radio unit shall resume hunting, see 9.4.1(j), and after confirming a control channel and receiving a suitable Aloha message, shall re-commence a random access registration attempt in accordance with section 8.2.2 of MPT1327.

Note that, until a successful registration is achieved, the radio unit shall not attempt to transmit other than RQR messages, or an acknowledgement in response to an Ahoy with IDENT1 = REGI (!!8.2.2.4!!), but shall continue to obey any received messages, provided that to do so does not involve transmitting on the control channel (other than RQR, or an ACK to an Ahoy with IDENT1 = REGI).

10.3.4.1.4 Registration Attempt Times Out

If the radio unit times out from waiting for further signalling for the registration (!!8.2.2.4!!), or cancels its wait state as defined in section 9.4.2, it shall enter the control channel acquisition procedures (section 9).

10.3.4.1.5 Registration Demand Received During a Random Access Registration Transaction

If, while waiting for a response to a random access registration request message, the radio unit receives an ALHR message individually addressed to it, the radio unit shall send a registration request RQR in accordance with MPT 1327 section 8.3.2.1 a2 (the radio unit shall not send an emergency request RQE).

The action shall then be as defined in sections 10.3.4.1.1 to 10.3.4.1.4, and in sections 7.3 and 8.2.2.2 of MPT 1327.

10.3.4.2 Registration on Demand

If, while confirmed on a control channel and not attempting to register by random access, a radio unit receives an applicable individually addressed ALHR, it shall write a NULL record against the existing registration record for the currently verified AREA code and shall attempt to register, complying with the procedures defined in MPT 1327 section 8.3.2.

Provided that the prime registration record is not now a NULL containing the same AREA code as the currently verified AREA code, then upon making a registration attempt (as a result of a demand) the radio unit shall:

- a) change the prime registration record, whether or not it has a NULL indicator appended to it, into a timed registration record with a newly-started timer, deleting, if necessary, the timed registration record closest to expiry (see section 10.3.6), and then,
- b) write into its prime registration record the AREA code for the system to which it is making the request together with a NULL indicator.

The radio unit action after transmitting RQR upon demand, whilst not attempting to register by random access, shall be as defined in sections 10.3.4.2.1 to 10.3.4.2.3.

10.3.4.2.1 Registration Accepted

On receipt of ACK(QUAL='0') the registration shall be considered accepted and the radio unit shall:

- a) convert the NULL prime record to a successful registration record (by removing the NULL indicator), and

- b) if the radio unit has received a REG parameter (see 10.3.7) since commencing the session, it shall label the registration record as either normal or temporary, corresponding to the latest received value of REG. If the radio unit has not received a REG parameter (see 10.3.7) since commencing the session, it shall label the registration record as undefined (see also 10.3.2.2 and 10.3.7).

10.3.4.2.2 Registration Denied

Registration is denied if ACKX(QUAL='0') is received. On receipt of this message the radio unit shall:

- a) write the AREA code in the list of denied registration records, and
b) enter the control channel acquisition procedures (section 9).

10.3.4.2.3 No Acknowledgement Received

If no response is received within WAIT+1 slots, the radio unit shall make no consequential changes to its registration record. If, as a result of the action prescribed in 10.3.4.2, the radio unit has no registration record for the verified AREA code, then it shall attempt to register by random access.

10.3.5 Implicit Registration

When a radio unit participates in a signalling transaction on a control channel for which it holds a timed registration record then, in the circumstances defined in this section, the radio unit is implicitly re-registered, and a prime registration record is created for the verified AREA code. Note that the requirements of this section apply only when the radio unit is tuned to a control channel for which it holds a timed successful registration record and only when the radio unit is in the normal operation mode (not in the fall-back mode).

10.3.5.1 Implicit Registration of Calling Radio Unit

Transmission of a random access message, other than RQR, RQX, or RQQ hook signalling, may result in implicit registration, as defined in sections 10.3.5.1.1 to 10.3.5.1.4.

10.3.5.1.1 Implicit Registration is Successful

Implicit registration shall be considered successful if any of the following messages applicable to the call are received:

- ACK(QUAL='0')
- ACK(QUAL='1') if cancellation of the call is requested
- ACKV
- ACKE(QUAL='0')
- ACKT(QUAL='0')
- ACKB(QUAL='0')
- GTC

On receipt of any of these messages (unless the prime registration record now corresponds to the verified AREA code) the radio unit shall:

- a) Delete the timed registration record corresponding to the verified AREA code (if the record still exists), and
- b) Convert the prime registration record to a timed registration record with a newly started timer, and
- c) Create a prime registration record for the verified AREA code, and
- d) If the radio unit has received a REG parameter (see 10.3.7) since commencing the session, it shall label the new prime registration record as either normal or temporary, corresponding to the latest received value of REG. If the radio unit has not received a REG parameter (see 10.3.7) since commencing the session, it shall label the registration record as undefined (see also 10.3.2.2 and 10.3.7).

If the prime registration record is a NULL for the verified AREA code, then on receipt of these messages the radio unit shall convert the prime record to a successful registration record (by removing the NULL indicator).

10.3.5.1.2 Implicit Registration Failed

Implicit registration shall be considered failed if ACKX applicable to the call is received. On receipt of ACKX the radio unit shall make no consequential changes to the registration records and shall return to the idle state.

10.3.5.1.3 Implicit Registration Times Out

If the radio unit times out from waiting for further signalling for a call (timeouts TA, TJ or TW), or cancels its wait state due to entering the control channel acquisition procedures (see 9.4.2), then (unless the prime registration record now corresponds to the verified AREA code, including if NULL) the radio unit shall:

- a) Convert the existing prime registration record to a timed registration record with a newly-started timer, deleting, if necessary, the timed registration record closest to expiry, and
- b) Create a NULL record as the prime registration record.

If the radio unit timed out from waiting (ie did not cancel its wait state), it shall then either return to the idle state or enter the control channel acquisition procedures (section 9).

10.3.5.1.4 Action at Switch-off or Equivalent

If, while the radio unit is waiting for further signalling for its call, the radio unit is switched off (or equivalent), or the user selects a different network, the radio unit shall (unless the prime registration record now corresponds to the verified AREA code, including if NULL)

create a NULL record as the prime registration record (note that the radio unit may be designed so that no processing is required after switch-off has been initiated).

10.3.5.2 Implicit Registration of Called Radio Unit

Transmission by the radio unit of ACK(QUAL = '0') in response to an AHY message for an incoming traffic channel call (!9.2.2.2A!!) may result in implicit registration as defined in sections 10.3.5.2.1 to 10.3.5.2.4.

10.3.5.2.1 Implicit Registration is Successful

Implicit registration shall be considered successful if a GTC or AHYX message applicable to the incoming call is received.

On receipt of either of these messages (unless the prime registration record now corresponds to the verified AREA code) the radio unit shall:

- a) Delete the timed registration record corresponding to the verified AREA code (if the record still exists and irrespective of whether the record is normal or temporary), and
- b) Convert the prime registration record to a timed registration record with a newly-started timer, and
- c) Create a prime registration record for the verified AREA code, and
- d) If the radio unit has received a REG parameter (see 10.3.7) since commencing the session, it shall label the new prime registration record as either normal or temporary, corresponding to the latest received value of REG. If the radio unit has not received a REG parameter (see 10.7) since commencing the session, it shall label the registration record as undefined (see also 10.3.2.2 and 10.3.7).

10.3.5.2.2 Implicit Registration Failed

If, while waiting for further signalling for an incoming traffic channel call, the radio unit receives an AHY message for a different incoming traffic channel call and sends ACK(QUAL = '0') or ACKI(QUAL = '0'), the radio unit shall make no consequential changes to the registration records and shall apply the procedures of 10.3.5.2 to the new AHY.

10.3.5.2.3 Implicit Registration Times Out

If the radio unit times out from waiting for further signalling for an incoming traffic channel call (timeout TA) or cancels its wait state due to entering the control channel acquisition procedures (see 9.4.2), then (unless the prime registration record now corresponds to the verified AREA code, including if NULL) the radio unit shall:

- a) change the prime registration record; whether or not it has a NULL indicator appended to it, into a timed registration record with a newly started timer, deleting,

if necessary, the timed registration record closest to expiry, and then,

- b) write into its prime registration record the AREA code for the system on which it is verified together with a NULL indicator.

If the radio unit timed out from waiting (ie did not cancel its wait state), it shall then return to the idle state.

10.3.5.2.4 Action on Switch-off or Equivalent

If, while the radio unit is waiting for further signalling for an incoming traffic channel call, the radio unit is switched off (or equivalent), or the user selects a different network, the radio unit shall (unless the prime registration record now corresponds to the verified AREA code, including if NULL) create a NULL record as the prime registration record (note that the radio unit may be designed so that no processing is required after switch-off has been initiated).

10.3.6 Registration Record Timeout

The timer for a registration record (timeout value TD) shall be started when the record is displaced from being prime registration record.

The radio unit shall delete any registration record (even a NULL record) displaced from being the prime registration record for which the time period TD has expired.

If the deletion on timeout occurs while the radio unit is active on a control channel, and results in the radio unit having no successful registration record corresponding to the received confirmation AREA code, the unit shall attempt to explicitly register by random access, see section 10.3.4.1.

10.3.7 Action on receiving broadcast registration parameters

- a) If the received value of NA is smaller than the number of registration records currently stored, the radio unit shall delete the excess number of records, retaining only the prime registration record and (NA-1) most recently created timed registration records.
- b) If the radio unit holds an undefined registration record for the verified AREA code, the record shall be labelled as either normal or temporary corresponding to the value of REG received.
- c) If the radio unit receives REG = '0' while active on a control channel, it shall record that the channel is in the normal registration mode.

If the radio unit holds a temporary registration record for the verified AREA code, it shall delete that record and attempt to register by random access.

- d) If the radio unit receives REG = '1' while active on a control channel, it shall record that the channel is in the temporary registration mode.

If the radio unit holds a normal registration record (not temporary) for the control channel, and the ZONE value of the verified system identity code differs from the 'home' ZONE of the radio unit, the radio unit shall label the registration record as temporary.

Note that b), c) and d) shall apply to all registration records held by the radio unit, not only the prime records.

10.3.8 Fall-back Mode

Any radio unit (whether or not it implements the fall-back mode option) which receives an ALHF message on a control channel for which the verified AREA code corresponds to a registration record, but for which the verified ZONE code does not match its home zone, shall label the registration record as temporary.

10.3.8.1 Entering Fall-back Mode

Upon entering fall-back mode (see 13.3) a radio unit shall continue to maintain registration records. Whilst in the fall-back mode and confirmed on the fall-back channel, the radio unit shall not attempt to register by random access or make use of control channel messages to implicitly register; the radio unit is free to initiate and receive calls even if the unit does not have a registration record for the verified AREA code.

10.3.8.2 Leaving Fall-back Mode

Upon leaving the fall-back mode the radio unit shall attempt to register if required to by sections 10.3.3 or 10.3.7.

11. CALL PROCESSING

In this section, the section numbers have been formed by prefixing the section numbers of MPT 1327 by "11.". Thus sub-sections here refer directly to, and should be read in parallel with, sections of MPT 1327. The requirements of MPT 1327 are also mandatory requirements of this specification. Each sub-section below defines the requirements for the facilities and functions relevant to the radio unit for call processing. These requirements are categorised as follows:

Mandatory	The radio unit shall implement the function or facility.
Standard Option	If the radio unit implements the function, then it shall be implemented at least in the specified manner.
Available for Customisation	If the TSC implements such a customised function, then if the radio unit implements the function it shall operate in the manner specified by the network operator of that TSC. Such functions will not modify existing standardised functions. If the radio unit does not understand the customised function in the context of system it is currently using, then it shall ignore that function. The radio unit shall not infringe any of the requirements of section 5 of MPT 1327.
Optional	The radio unit may use the information or implement the facility at the discretion of the manufacturer.
Informative	The corresponding section within MPT 1327 is primarily informative or related only to TSC specification, with no requirements on the radio unit arising directly from the contents. Related requirements may be included in other sections, however.

The radio unit shall ignore those fields of received messages which it does not understand.

11.1 Introduction

Informative.

11.1.1 User Facilities

Informative.

11.1.1.1 Types of Call

Informative.

11.1.1.2 Making Calls

It shall be mandatory for the radio unit to be able to make calls to individual radio units and

line connected units. The ability to make calls to the other destinations listed is a standard option.

It shall be mandatory for the radio unit to be able to make interprefix speech calls, although this does not necessarily require prefix number entry by the user (see section 8.2).

The requirements on the radio unit for the use of call progress information sent by the TSC for confidence indication is defined in section 8.1.

11.1.1.3 Receiving Calls

The requirement to respond to correctly addressed incoming calls that are received is mandatory. This requirement includes interprefix calls. The response may, however, be a rejection if, for example, a radio unit does not have a particular non-mandatory facility, or if the user has indicated that certain calls are to be rejected.

The implementation of a busy control is a standard option.

The implementation of a call back control is a standard option.

The implementation of a "ready for communication control" (RFCC) is mandatory.

Confidence indication requirements are specified in section 8.1.

11.1.1.4 Diverting Calls

Diversion of calls is a standard option. Automatic re-dial to the diversion IDENT is optional.

11.1.2 System Features and Facilities

11.1.2.1 System Dimensions

It shall be mandatory for the radio unit to be able to store in its personality any one of the addresses in the full addressing range as its individual address. In addition it shall be mandatory for the radio unit to be able to store in its personality up to 4 of the addresses in the full addressing range as its group addresses (see section 6).

11.1.2.2 System Control

Informative. See section 13 of this specification for details of fall-back operation, which is a standard option.

11.1.2.3 Call Handling

Informative. The requirements for security are defined in section 11.15.

11.1.2.4 Multi-site Systems

Informative. The registration procedures are defined in Section 10 of this specification.

11.1.3 Guide to Some Key Protocol Aspects

Informative.

11.1.3.1 Control Channel Signalling Structure

Informative.

11.1.3.2 Control Channel Signalling Messages

Informative.

11.1.3.3 Random Access Protocol

11.1.3.3.1 Principle of Operation

Informative.

11.1.3.3.2 Features of the Random Access Protocol

Informative.

11.1.3.4 Addressing

Informative. The use of extended addressing is mandatory for a radio unit making a simple call to a radio unit or line unit with a different prefix.

11.1.3.5 Examples of Signalling Sequences

Informative.

11.1.3.5.1 Example: Radio Unit Calls a Group

The ability to make group calls is a standard option.

11.1.3.5.2 Example: Radio Unit Calls a Unit with the Same Prefix

The ability for the radio unit to make such calls is mandatory.

11.1.3.5.3 Example: Radio Unit Calls a Unit with a Different Prefix

The ability for the radio unit to make such calls is mandatory.

11.1.3.5.4 Example: Radio Unit Sends a Short Data Message

The ability for the radio unit to make such calls is a standard option.

11.2 Definitions

The definitions listed in section 2 of MPT 1327 are consistent with those listed in section 3 of this specification.

11.3 Signalling Formats

Informative. The requirements listed in this section apply only to prescribed signalling. Non-prescribed signalling is not covered by this specification.

11.3.1 Basic Format

Mandatory as specified.

11.3.1.1 LET

Mandatory as specified.

11.3.1.2 Preamble

Mandatory as specified.

11.3.1.3 Message

Mandatory as specified.

11.3.1.4 Hang-over Bit, H

Mandatory as specified.

11.3.2 Message Format

Mandatory as specified.

11.3.2.1 Codeword Synchronisation Sequence

Mandatory as specified.

11.3.2.1.1 Control Channel Codeword Synchronisation Sequence

Mandatory as specified.

11.3.2.1.2 Traffic Channel Codeword Synchronisation Sequence

Mandatory as specified.

11.3.2.2 Codewords

Mandatory as specified.

11.3.2.3 Encoding and Error Checking

The encoding is mandatory as specified.

The radio unit shall not accept any codeword from which the derived syndrome and parity bit indicate that 3 or more hard errors have occurred in an error burst of length 6 bits or greater.

The radio unit shall reject any codeword if it does not correct potential bit errors indicated by the coset leader for the syndrome.

The radio unit need not perform error correction, although error correction may simplify receiver and modem design requirements in meeting the error performance requirements of the receiver specified in Appendix A.

11.3.3 Signalling Transmission Variants

The radio unit shall be designed to cope with the variants specified.

11.3.3.1 Single Message Format

Mandatory as specified.

11.3.3.2 Multiple Message Format on the Traffic Channel

Mandatory as specified.

11.3.3.3 Forward Control Channel Format

11.3.3.3.1 Basic Control Channel Format

Mandatory as specified.

11.3.3.3.2 Data Codeword Displacement

Mandatory as specified.

11.4 Addressing

The radio unit shall understand those special IDENTs and DUMMYI that are required by the mandatory call procedures, and also those required by any standard options that are implemented.

11.5 Codeword Structures

The standardised messages which the radio unit shall understand are defined in the following sections.

Standardised Fields

Mandatory as specified.

Reserved Fields

Mandatory as specified.

Spare Fields and Codewords

Available for Customisation in the manner specified.

11.5.1 Control Channel System Codeword (CCSC)

Mandatory to make use of the CCSC for slot synchronisation.

The use of the DCSU is a standard option.

11.5.2 General Address Codeword Structures

Informative.

11.5.3 List of Address Codewords

Messages received by the radio unit which it shall understand and take any mandatory action required:

GTC

ALH, ALHS, ALHX, ALHR, ALHF

ACK, ACKI, ACKQ, ACKX, ACKV, ACKT, ACKB

ACKE (if configured to send RQE messages)

AHY, AHYX, AHYQ, AHYC

MAINT, MOVE, CLEAR, BCAST

Messages received by the radio unit which it shall understand and take any mandatory action required if the unit is individually addressed, and for which it is a standard option for the radio unit to use if not individually addressed:

ALHD, ALHE

Messages received by the radio unit which it is a standard option for the radio unit to understand:

AHYD
DACK +DAL, DACK+DALG, DACK+DALN, DACK+GO, DACKD, DACKZ, DAHY,
DAHXY, DAHYZ
GTT, MARK, HEAD
RLA, SACK, SITH

Messages for which the functions are not yet defined (informative):

SAMO

Messages which the radio unit shall be required to send by the protocol (mandatory):

ACKI (QUAL = '0')
ACK, ACKX
RQS, RQX, RQR, RQQ (indicating hook status)
MAINT (see section 11.5.5.4.2 for applicable messages)
SAMIS

Messages which the radio unit may send in the standardised format if permitted by the protocol (standard option):

ACKV, ACKB
RQT, RQE, RQC, RQQ (other than for hook status)
DACK+GO, DACKD, DACKZ
DRQG, DRQX, DRQZ, DRUGI
RLA, RQD, SACK, SITH
HEAD

Messages for which the functions are not yet defined (informative):

SAMIU

Reserved and spare message fields shall be as specified.

11.5.4 Go To Traffic Channel Message, GTC

Mandatory as specified.

11.5.5 Category '000' Messages

11.5.5.1 Aloha Messages (Type '00')

It is mandatory that the radio unit shall use the following received messages in making random access attempts:

ALH, ALHS, ALHX, ALHR

It is a standard option that the radio unit shall use the following received messages in random access attempts:

ALHD, ALHE

It is mandatory for the radio unit to understand the ALHF message; it is a standard option for the radio unit to implement fall-back mode (see section 13).

Use of the WT, M, CHAN4 and N fields shall be mandatory when making use of any Aloha message. The CHAN4 bits correspond to the 4 least significant bits of the 10 bit channel number CHAN (see section 5).

It is mandatory that the radio unit shall respond to all individually addressed Aloha messages (ie those addressed to that specific unit, see !!7.4.1!!).

11.5.5.2 Acknowledgement Messages (Type '01')

Messages received by the radio unit which it shall understand and take any mandatory action required:

ACK, ACKI, ACKQ, ACKX, ACKV, ACKT, ACKB

Messages received by the radio unit which it shall understand and take any mandatory action required if the radio unit is configured to send RQE messages:

ACKE

Messages which the radio unit shall send where required by the protocol (mandatory):

ACK, ACKX, ACKI (QUAL = '0')

Messages which the radio unit may send in the standardised format if permitted by the protocol (standard option):

ACKV, ACKB

11.5.5.2.1 Acknowledgement Messages Sent by the TSC

Messages received by the radio unit which it shall understand and take any mandatory action required:

ACK, ACKI, ACKQ, ACKX, ACKV, ACKT, ACKB
ACKE (if configured to send RQE messages)

Use of the QUAL field of the received message is a standard option except where:

- i. mandatory confidence indications are required in section 8.1;

- ii. the protocol of MPT 1327 requires a different mandatory action based on the QUAL field.

Use of the diversion address or number of data codewords appended to ACKT (QUAL = '0') is optional. If IDENT1=PSTNGI in ACKT (QUAL='0') then the BCD digits in the appended data codeword (s) shall contain the full dialled string, less the leading 0.

ACKT (QUAL = '1') is reserved.

11.5.5.2.2 Acknowledgements Sent by Radio Units

Messages which the radio unit shall send where required by the protocol (mandatory):

ACK (QUAL = '0' and QUAL = '1'), ACKX (QUAL = '0'), ACKI (QUAL = '0')

Messages which the radio unit may send in the standardised format if permitted by the protocol (standard option):

ACKV (QUAL = '1'), ACKX (QUAL = '1'),
ACKB (QUAL = '0' and QUAL = '1')

11.5.5.3 Type '10' Messages (Requests and Ahoys)

Informative.

11.5.5.3.1 Request Messages (Type '10')

Messages which the radio unit shall send where required by the protocol when making calls (mandatory):

RQS, RQX, RQR
RQQ (for hook status)

Messages which the radio unit may send in the standardised format if permitted by the protocol (standard option):

RQT, RQE, RQC
RQQ (other than hook status)

11.5.5.3.1.1 Request "Simple" Call Message, RQS

Mandatory for RQS containing:

(IDENT1 = Ident or IPFIXI) and
DT = '0' and
LEVEL = '1' and
EXT = '0' and

FLAG1 = '0' and
FLAG2 = '0'

Standard option for other combinations.

11.5.5.3.1.2 Request Codeword Free for Customisation

Section deleted in MPT 1327.

11.5.5.3.1.3 Call Cancel/Abort Transaction Request Message, ROX

Mandatory as specified.

11.5.5.3.1.4 Request Call Diversion Message, ROT

Standard option.

11.5.5.3.1.5 Request Emergency Call Message, ROE

Standard option.

11.5.5.3.1.6 Request to Register Message, ROR

Mandatory as specified.

The "Info" field shall be set to all zeros, unless permitted otherwise by the network.

11.5.5.3.1.7 Request Status Transaction, ROQ

Mandatory for indication of hook status (see MPT 1327 section 13). Standard option otherwise.

11.5.5.3.1.8 Request to Transmit Short Data Message, ROC

Standard option.

11.5.5.3.2 Ahoy Messages (Type '10')

Messages received by the radio unit which it shall understand and take any mandatory action required:

AHY, AHYX, AHYQ, AHYC

11.5.5.3.2.1 General Availability Check Message, AHY

It is mandatory that the radio unit responds to an individually addressed AHY message. Use of the address in any data codeword appended to the AHY is a standard option.

11.5.5.3.2.2 Reserved Section

Informative.

11.5.5.3.2.3 Cancel Alert State Message, AHYX

Mandatory as specified.

11.5.5.3.2.4 Reserved Section

Informative.

11.5.5.3.2.5 Reserved Section

Informative.

11.5.5.3.2.6 Reserved Section

Informative.

11.5.5.3.2.7 Status Ahoy Message, AHYQ

Mandatory as specified.

11.5.5.3.2.8 Short Data Invitation Message, AHYC

Mandatory as specified.

11.5.5.4 Miscellaneous Control Messages (Type '11')

Messages received by the radio unit which it shall understand and take any mandatory action required:

MAINT, MOVE, CLEAR, BCAST

Messages received by the radio unit which it is a standard option for the mobile to understand:

MARK

Messages which the radio unit shall send where required by the protocol (mandatory):

MAINT (see section 11.5.5.4.2 for applicable messages)

11.5.5.4.1 Control Channel Marker, MARK

It is a standard option whether the radio unit makes use of the MARK message.

The CHAN4 bits correspond to the 4 least significant bits of the 10 bit channel number CHAN (see section 5).

11.5.5.4.2 Call Maintenance Message, MAINT

Messages received by the radio unit which it shall understand and take any mandatory action required:

MAINT (OPER = '110', '111')

Messages which the radio unit shall send where required by the protocol (mandatory):

MAINT (OPER = '000', '001', '010', '011')

For OPER = '110' or OPER = '111' the message format is as follows:

1	PFIX	IDENT1	1	CAT 000	TYPE 11	FUNC 001	CHAN	OPER	RSVD	STI	SIL3	P
1	7	13	1	3	2	3	10	3	1	1	3	16

Field definitions are as for MPT 1327 with the addition of:

STI - Site Indicator Flag. If non-zero then SIL3 holds the three least significant bits of the SIL sub-field of the system identity code (SYS) currently being propagated by the system originating the message.

SIL3 - The three least significant bits of the SIL sub-field of the system identity code (SYS) currently being propagated by the system originating the message.

For STI = '0' then SIL3 = RSVD (RSVD = '000')

It is mandatory for the radio unit to understand and act on the messages:

MAINT (OPER = '110') (See also 11.9.2.3.7)

MAINT (OPER = '111') (See also 11.9.2.3.3)

It is mandatory for the radio unit to send these messages where required by the protocol:

MAINT (OPER = '000', '001', '010', '011')

For OPER = '110' or OPER = '111', the STI and SIL3 fields are reserved and shall be set to zero for MAINT messages transmitted by radio units.

11.5.5.4.3 Clear-Down Message, CLEAR

Mandatory as specified.

If the radio unit receives a CLEAR message with the CONT field set to '000000000' then the radio unit shall either return to the last active control channel, or remain on the nominated fall-back channel if in fall-back mode (see Sections 9 and 13).

The message format is as follows:

1	CHAN	CONT	1	CAT 000	TYPE 11	FUNC 010	STI	SIL3	TSI	SPARE	REVS 101010101010	P
1	10	10	1	3	2	3	1	3	1	1	12	16

Field definitions are as for MPT 1327 with the addition of:

STI - Site Indication Flag. If non-zero then SIL3 holds the three least significant bits of the SIL sub-field of the system identity code (SYS) currently being propagated by the system originating the message.

SIL3 - The three least significant bits of the SIL sub-field of the system identity code appropriate to the system originating the message.

For STI = '0' then SIL3 = RSVD (RSVD = '000')

TSI - Time-shared control channel indicator. See section 9.

'0' - Time-shared control channels are not expected on channel number CONT.

'1' - Time-shared control channels may be encountered on channel number CONT.

11.5.5.4.4 Move to Control Channel, MOVE

Mandatory as specified.

The radio unit shall enter a "preferential hunt" if it receives a MOVE message with the CONT field set to '000000000' (see section 9).

The message format is as follows:

1	PREFIX	IDENT1	1	CAT 000	TYPE 11	FUNC 011	CONT	(M)	RSVD	TSI	P
1	7	13	1	3	2	3	10	5	2	1	16

Field definitions are as for MPT 1327 with the addition of:

TSI - Time-shared control channel indicator. See section 9.

'0' - Time-shared control channels are not expected on channel number CONT.

'1' - Time-shared control channels may be encountered on channel number CONT.

11.5.5.4.5 Broadcast Message, BCAST

Mandatory for the following SYSDEF value:

'00010' Specify call maintenance parameters
 '00011' Specify registration parameters

Standard option for the following SYSDEF values:

'00000' Announce control channel
 '00001' Withdraw control channel
 '00100' Broadcast adjacent site control channel number
 '00101' Vote now advice

11.5.5.4.5(a) Announce Control Channel (SYSDEF = '00000')

Standard option.

The message format is as follows:

1	SYSDEF 00000	SYS	1	CAT 000	TYPE 11	FUNC 100	CHAN	TSI	SPARE	RSVD	P
1	5	15	1	3	2	3	10	1	1	6	16

Field definitions are as for MPT 1327 with the addition of:

TSI - Time-shared control channel indicator. See section 9.

'0' - Time-shared control channels are not expected on channel number CHAN.

'1' - Time-shared control channels may be encountered on channel number CHAN.

11.5.5.4.5(b) Withdraw Control Channel (SYSDEF = '00001')

Standard option.

11.5.5.4.5(c) Specify Call Maintenance Parameters (SYSDEF = '00010')

The message format is as follows:

1	SYSDEF 00010	SYS	1	CAT 000	TYPE 11	FUNC 100	PER	IVAL	PON	ID	RSVD	TSCLIM	P
1	5	15	1	3	2	3	1	5	1	1	2	8	16

All facilities listed in MPT1327 are mandatory. Field definitions are as for MPT1327 with the addition of:

TSCLIM - Specifies the maximum traffic channel call duration for non-emergency calls.

The binary values used are as follows:

'00000000': Duration to be CLIM

'00000001 to '00001001': Duration to be the decimal equivalent of the binary field value in minutes plus 4 minutes.

'00001010' to '11111110': Duration to be the decimal equivalent of the binary field value in seconds.

'11111111': Call timer infinite.

11.5.5.4.5(d) Specify Registration Parameters (SYSDEF = '00011')

It is mandatory for the radio unit to understand and act on this message.

The message format is as follows:

1	SYSDEF 00011	SYS	1	CAT 000	TYPE 11	FUNC 100	RSVD	NA	REG	SPARE	RFFD	P
1	5	15	1	3	2	3	4	2	1	5	6	16

Field definitions are as for MPT 1327 with the addition of:

NA - Specifies the maximum number of registration records which a radio unit shall store (see section 10):

'00' reserved for future definition in MPT 1343

'01' one registration record

'10' two registration records

'11' three registration records

REG - Specifies registration mode (see section 10):

'0' normal

'1' temporary

RFFD - Reserved for future definition in MPT 1343.

Default value = '000000'.

11.5.5.4.5(e) Broadcast Adjacent Site Control Channel Number (SYSDEF = '00100')

Standard option.

The message format is as follows:

1	SYSDEF	SYS	1	CAT 000	TYPE 11	FUNC 100	CHAN	TSI	SPARE	RSVD	ADJSITE	P
1	5	15	1	3	2	3	10	1	1	2	4	16

Field definitions are as for MPT 1327 with the addition of:

- TSI - Time-shared control channel indicator. See section 9.
- '0' - Time-shared control channels are not expected on channel number CHAN.
- '1' - Time-shared control channels may be encountered on channel number CHAN.

11.5.5.4.5(f) Vote Now Advice (SYSDEF = '00101')

Standard option.

1	SYSDEF 00101	SYS	1	CAT 000	TYPE 11	FUNC 100	CHAN	TSI	SPARE	RSVD	ADJSITE	P
1	5	15	1	3	2	3	10	1	1	2	4	16

Field definitions are as for MPT 1327 with the addition of:

- TSI - Time-shared control channel indicator. See section 9.
- '0' - Time-shared control channels are not expected on channel number CHAN.
- '1' - Time-shared control channels may be encountered on channel number CHAN.

11.5.6 Category '001' Messages

11.5.6.1 Single Address Messages (Type '0')

11.5.6.1.1 Outbound Single Address Messages, SAMO

The basic word format is informative.

11.5.6.1.2 Inbound Single Address Messages

11.5.6.1.2.1 Inbound Unsolicited Single Address Message, SAMIU

The basic word format is informative.

11.5.6.1.2.2 Inbound Solicited Single Address Message, SAMIS

Mandatory for Mode 1, DESC = '000' (Interprefix calls).

Mandatory for Mode 2, DESC = '000' (Serial number transfer).

Standard option otherwise.

11.5.6.2 Short Data Message Header, HEAD (Type '1')

Standard option.

11.5.7 Codewords applicable to Standard Data

11.5.7.1 Request Standard Data Communication RQD

Standard option.

11.5.7.2 Availability Check for Standard Data AHYD

Standard option.

11.5.7.3 Go to Transaction GTT

Standard option.

11.5.7.4 Standard Data Random Access Radio Unit General Information DRUGI

Standard option.

11.5.8 Codewords applicable to Standard Data Transactions

11.5.8.1 Standard Data General Purpose Acknowledgement DACKD

Standard option.

11.5.8.2 Standard Data Codeword DACK containing Submessages DAL,DALG,DALN
or GO

Standard option.

11.5.8.3 Standard Data Acknowledgement for Expedited Data DACKZ

Standard option.

11.5.8.4 Standard data General Ahoy DAHY

Standard option.

11.5.8.5 Standard Data Ahoy containing expedited Data DAHYZ

Standard option.

11.5.8.6 Standard Data Ahoy for closing a Trans DAHYX

Standard option.

11.5.8.7 Repeat last ACK - RLA

Standard option.

11.5.8.8 Repeat Group Message DROZ

Standard option.

11.5.8.9 Request containing expedited Data DROZ

Standard option.

11.5.8.10 Request to close a Transaction DRQX

Standard option.

11.5.8.11 Standard Data Selective Acknowledgement Header SACK

Standard option.

11.5.8.12 Standard Data Address codeword for a Dataitem SITH

Standard option.

11.6 Channel Discipline

Informative.

11.6.1 Channel Discipline for TSC

11.6.1.1 Control Channel Discipline for TSC

Informative.

11.6.1.2 Traffic Channel Discipline for TSC

11.6.1.2.1 Monitoring

Informative.

11.6.1.2.2 Signal Timing

Informative.

11.6.2 Channel Discipline for Radio Units

11.6.2.1 Control Channel Discipline for Radio Units

11.6.2.1.1 Control Channel Acquisition

Mandatory where specified. The radio unit shall also meet the requirements of section 9 of this specification.

11.6.2.1.2 Retaining a Control Channel

Mandatory as specified, where:

- an applicable system identity code is any system identity code where bits 1-12 differ from the verified value or where bits 13-15 (LAB) are a value which does not permit access to the control category assigned to the radio unit;
- appropriate codewords are CCSC's and, if the radio unit is equipped to receive them, MARK messages;
- a correct value of the system identity code is one in which bits 1-12 of the SYS field from a received appropriate codeword match bits 1-12 of the verified value value and bits 13-15 (LAB) are a value which permits access to the control category assigned to the radio unit.

The radio unit shall also meet the requirements of section 9 of this specification.

11.6.2.1.3 Signal Timing

Mandatory as specified.

The reception-to-reception retuning time limits stipulated in MPT 1327, [6.2.1.3], [6.2.2.1], [7.4.2], [9.2.2.5], [9.2.3.4] and [9.2.3.8] all refer to the time between the end of the relevant invoking codeword and the start of the last 16 bits of the preamble to the standard data message on the new channel. The only requirement is to be able to decode such a message.

Time limits for satisfactory reception of speech or non-standard data are not specified.

11.6.2.2 Traffic Channel Discipline for Radio Units

11.6.2.2.1 Monitoring

Mandatory as specified.

For definition of the re-tuning time limits, see 11.6.2.1.3.

11.6.2.2.2 Signal Timing

Mandatory as specified.

11.6.2.2.2.1 Radio Unit Response

Mandatory as specified.

11.6.2.2.2.2 Unsolicited Transmission that Requires a Response

Standard option.

11.7 Random Access Protocol

Informative.

11.7.1 The Principle

Informative.

11.7.2 TSC Random Access Facilities

11.7.2.1 Marking Random Access Frames

Informative.

11.7.2.2 Subdividing the Radio Unit Population

Informative.

11.7.2.3 Inviting Specific Types of Random Access Frame

Informative.

11.7.2.4 TSC Responses

Informative.

11.7.2.5 Withdrawing Slots from Frames

Informative.

11.7.3 Radio Unit Random Access Protocol

Mandatory as specified.

11.7.3.1 Checking Subsets of the Radio Unit Population

Mandatory as specified.

11.7.3.2 Checking the Aloha Function

Mandatory as specified. The recognition of ALHF is mandatory; the implementation of the fall back mode is a standard option (see section 13).

11.7.3.3 Frames Defined by Aloha Numbers

Mandatory as specified.

11.7.3.4 First Try Option

Standard Option as stated.

11.7.3.5 Choosing a Slot from a New Frame

Mandatory as specified.

11.7.3.6 Check for Withdrawn Slot

Mandatory as specified. It is mandatory for the radio unit not to make a random access when a codeword is not decodable (or no signal is received) (item d. of MPT 1327 section 7.3.6).

11.7.3.7 Noting the Response Delay

Mandatory as specified. The required value of parameter NW is defined in Appendix B of this specification.

11.7.3.8 Retry Decision and Time-outs

Mandatory as specified. Requirements for confidence indications are given in section 8.1. The required values of timeout and default parameters listed are defined in section 6 and Appendix B of this specification.

11.7.4 Related Procedures for all Radio Units on a Control Channel

11.7.4.1 Individually Addressed Aloha Message

Mandatory as specified.

11.7.4.2 MOVE Message

Mandatory as specified (see also section 11.5.5.4.4). For definition of the retuning time limits, see 11.6.2.1.3.

11.8 Registration Procedures

Informative. Mandatory requirements for registration are specified in section 10 of this specification.

11.8.1 Registration Facilities

Informative. The function of ALHF is specified in sections 9 and 13.

11.8.2 Procedures for Registration by Random Access

11.8.2.1 TSC Procedures

Informative.

11.8.2.1.1 Responses to a Random Access RQR Message

Informative.

11.8.2.1.2 Acknowledgements Sent to Indicate Progress of Registration

Informative.

11.8.2.1.3 TSC Time-out

Informative.

11.8.2.2 Radio Unit Procedures for Registration by Random Request

11.8.2.2.1 Criteria for Registration

Mandatory where specified. The requirements placed on the radio unit as regards registration are given in section 10. The radio unit shall not attempt random access to a system unless that system is identified in its personality (see section 6). Where a system requires a radio unit to register, the radio unit shall be required to register successfully before attempting to make any calls.

11.8.2.2.2 Registration Request and Valid Responses

Mandatory where specified. The required values of timeout and default parameters listed are defined in section 6 and Appendix B of this specification. The radio unit shall set the INFO field to all zeros, unless permitted otherwise by the network.

11.8.2.2.3 Acknowledgement Received

Mandatory where specified. The action that the radio unit shall take when registration is denied is defined in section 10 of this specification.

11.8.2.2.4 Time-out after Waiting

Mandatory where specified. The action that the radio unit shall take when registration is denied is defined in section 10 of this specification.

11.8.3 Procedures for Registration on Demand

11.8.3.1 TSC Procedures for Demanding Registration

Informative.

11.8.3.2 Radio Unit Procedures for Registration on Demand

11.8.3.2.1 Individually Addressed ALHR Message

Items a1, a2: mandatory as specified. Item b: all radio units shall have the capability to register, and hence the radio unit shall respond with RQR in this case. Item c. is not applicable.

11.8.3.2.2 Response to RQR sent on Demand

Mandatory as specified. Additional mandatory requirements are placed on the radio unit in section 10 of this specification.

11.9 Basic Call Procedures

Informative.

It shall be mandatory for the radio unit to be able to make "simple" calls to the following destinations:

- Radio units and line units with the same prefix.
- Radio units and line units with a different prefix.

It is a standard option for the radio unit to make "simple" calls to destinations other than those listed above.

It is a standard option for a radio unit to make the following calls:

- Calls to a group.
- Calls to all units on a system.

11.9.1 Basic Call Procedures for TSC

Informative.

11.9.1.1 Basic TSC Procedures for Setting Up Calls

11.9.1.1.1 Responses to a Short Addressing ROS Message

Informative.