MPT 1327

A Signalling Standard

for Trunked Private Land Mobile Radio Systems

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~~Part 1~~

MPT 1327

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A SIGNALLING STANDARD FOR

TRUNKED PRIVATE LAND MOBILE RADIO SYSTEMS

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1	October 1990	Incorporated in the version reprinted in October 1990. Amended text was highlighted by a bar in the margin.

FOREWORD

This standard defines the rules for communication between radio units and trunking system controllers operating in trunked private land mobile radio systems.

Applications and test conditions for this standard, applicable to Band III, are contained in the following specifications prepared by the Department of Trade and Industry, Radiocommunications Agency.

MPT 1343	System interface specification for radio equipment to be used with commercial trunked networks operating in Band III, sub-bands 1 and 2.
MPT 1347	Radio interface specification for commercial trunked networks operating in Band III, sub-bands 1 and 2.
MPT 1352	Test schedule for the approval of radio units to be used with commercial trunked networks operating in Band III, sub-bands 1 and 2.

Intellectual Property Rights

Firms intending to manufacture equipment which complies with the standard should be aware that certain features of the standard are subject to IPR claims.

All firms are therefore advised that they should make appropriate enquiries through their Patent Agents before proceeding.

CONTENTS

1. INTRODUCTION

MPT1327 is a signalling standard for trunked private land mobile radio systems. It defines the protocol rules for communication between a trunking system controller (TSC) and users' radio units.

The standard can be used to implement a wide variety of systems, from small systems with only a few radio channels (even single-channel systems), through to large networks which may be formed by the interconnection of TSCs.

The protocol offers a broad range of user facilities and system options. However, it is not necessary to implement all of the facilities available; an appropriate subset of the protocol could be implemented, according to the user requirements. Also, there is scope for customisation for special requirements, and provision has been made for further standardised facilities to be added to the protocol in the future.

The standard defines only the over-air signalling and imposes only minimum constraints on system design. Additional specifications will be required for specific implementations, for example, to define:

- the facilities that must be implemented
- parameter values
- a channel plan
- for a network, criteria for when a radio unit should register.

Section 1.1 of this introduction describes the user facilities which are explicitly provided by the protocol. (It does not describe additional facilities which may be offered in a radio unit but which do not require any specific protocol.)

Section 1.2 describes some protocol features, indicating the options available to system designers.

Section 1.3 provides an introduction to the operation of the protocol.

Subsequent sections of this document contain the protocol definition. In most of these sections, the protocol rules for the TSC and for radio units are specified separately, but with cross-referencing where convenient.

1.1 User Facilities

The facilities available to users are outlined below. For a full definition of the facilities, see the sections indicated.

1.1.1 Types of call

The standard protocol enables radio units to make the following types of call.

a. Speech call. (See section 9.)

Speech calls may be requested with normal or high priority. For group calls, the calling party may opt for a conversational mode, where all parties are able to speak, or for an announcement mode where only the caller may speak.

b. Data call, for the transmission of non-prescribed signalling. (See section 9.)

Parameters are available to specify either normal or high priority and, for a group call, whether the called group members can reply. (Provision has been made for specifying a standard method of data communication in the future).

c. Emergency call. (See section 10.)

Parameters are available to specify either a speech or a data call and, for a group call, whether the called group members can reply. Also, a radio unit may request a special mode of emergency service previously arranged with the system; the TSC determines the required action by reference to the calling unit's address.

d. Include call. (See section 11.)

During a call, a unit may request that another party joins the call. This facility may be used to implement a Conference Call or Call Transfer.

e. Status message. (See section 13.)

Thirty-two different status messages may be conveyed between units. The meanings of two of these messages are prescribed as a "call-me-back request" and "cancel previous call-me-back request". The remaining thirty messages have user-defined meanings. (Status messages can also be sent between radio units and the TSC.)

f. Short Data Message. (See section 14.)

Messages of up to 184 bits of free format data can be sent between units, or between units and the TSC.

1.1.2 Making calls

A radio unit may request a call to any of the following called parties (except for status messages, which cannot be addressed to PABX or PSTN destinations or to groups):

- an individual radio unit or line-connected unit
- a group, or all units in the system
- a PABX number, up to nine digits
- a PSTN number, up to 31 digits.

In addition, status messages and short data messages may be sent to the TSC.

During call set-up, the TSC may pass a wide variety of information to the caller, to indicate the progress of the call. For example, it may indicate the reason for any delays in call set-up or the reason for a call failure.

A call request may be cancelled at any time.

1.1.3 Receiving calls

A radio unit may receive calls from a radio unit or line unit, or (except for status messages) from a PABX extension or the PSTN. In addition, status messages and short data messages may be received from the TSC. For a call from a radio unit, a line unit or the TSC, the calling address may be supplied to the called unit. For a call from a PABX extension or from the PSTN, the calling gateway is indicated as the source of the call but the caller's number is not conveyed to the called unit.

Incoming calls may be addressed to the unit individually or to a group to which it belongs. A radio unit may be a member of an arbitrary number of groups; its group addresses can be chosen independently of its individual address.

A radio unit may refuse to accept all incoming calls, for example by means of a "busy" or "out-of-vehicle" control, or incoming calls could be refused selectively, depending on the source of the call. If a user does not wish to proceed with an incoming call immediately, he can indicate that he will call back later.

Systems may be configured to alert a called individual and require him to indicate that he is ready, before a traffic channel is allocated for a call.

1.1.4 Diverting Calls

If a radio unit does not wish to receive calls, it may request that future calls addressed to it be redirected to a specified alternative destination. A radio unit may also request redirection on behalf of a third party, for example, for a unit which is not equipped for call diversion. A radio unit calling a diverted party will be informed of the alternative destination to try; it may then re-make the call automatically, or it may give the user the option of deciding whether to call the alternative destination. See section 12 for the full diversion facilities.

1.2 System Features and Facilities

1.2.1 System dimensions

The numbering range of the protocol accommodates:

- 1,036,800 addresses per system
- 1024 channel numbers
- 32768 system identity codes.

1.2.2 System control

The protocol uses signalling at 1200 bit/s with Fast Frequency Shift Keying (FFSK) subcarrier modulation. It is designed for use by two-frequency half-duplex radio units and a duplex TSC.

The signalling for setting up calls is transmitted on a "control" channel. A TSC can be operated using either of two control channel strategies: dedicated or non-dedicated. A dedicated system has a control channel permanently available for signalling, whereas a non-dedicated system may assign the control channel for traffic (speech or data communication) if all the other channels are in use. The use of a dedicated control channel is appropriate for a TSC with many channels, whereas a non-dedicated control channel may be more appropriate for a TSC with only a few channels. The protocol allows the use of either strategy.

Broadcast messages are available to inform radio units of system information, such as the channels which the system may use for control signalling.

One of the problems of mobile radio signalling systems is the clashing of messages from different radio units transmitting at the same time. The problems of clashing are controlled by an access protocol which offers high efficiency, stability and flexibility. (See section 1.3.3 and section 7.)

Protection against interference is provided by labelling the signalling with a system identity code and, in some messages, the channel number. If heavy interference is encountered, control can be changed to a different channel.

To cope with system malfunction, a customised fall-back mode of operation may be defined by the system designer.

1.2.3 Call handling

The protocol is designed for use by systems which queue calls that cannot be set up immediately, for example, if no channel is currently available for traffic.

Before a traffic channel is assigned for a call to an individual radio unit, the TSC checks that the called unit is in radio contact, in order to avoid wasted channel assignments. It may also check that the radio unit's operator is ready for the call, to avoid a traffic channel being assigned to an unmanned unit.

Call maintenance signalling is defined for prompt release of traffic channels at the end of a conversation, or in case communication is lost during a call. (See section 1.3.5 and section 9.)

As a precaution against fraudulent use of a system by an unauthorised radio unit, the TSC may at any time instruct a radio unit to transmit its unique serial number; comparison of the received serial number with the expected value will assist in the detection of fraudulent users. (See section 15.)

1.2.4 Multi-site systems

The standard leaves scope for various multi-site wide-area coverage techniques to be used, for example:

- synchronous/quasi-synchronous operation
- a separate control channel at each site
- a single control channel shared by time division.

The protocol includes a registration facility to assist the implementation of multi-site systems and networks of TSCs: a radio unit can inform the TSC of its location as it roams between sites or systems. (The system identity code distinguishes the signalling from different sites and systems). The standard defines signalling procedures for registration (section 8), but the criteria for registration will be system-dependent.

A TSC can broadcast information to assist radio units hunting for a control channel when they roam; for example, it can announce the channels which may be used for control by itself or by TSCs on adjacent sites.

1.3 Guide to Some Key Protocol Aspects

This section provides an introduction to the operation of the protocol which, because of its scope and flexibility, is necessarily complex. The section outlines the control channel structure, the random access protocol and some message exchange procedures for call set-up.

This section is intended only as a guide: it should not be regarded as a protocol specification. Readers should refer to the main body of the standard for the complete and precise definition.

1.3.1 Control channel signalling structure

The signalling for setting up calls is transmitted on a "control" channel. Time on the control channel is divided into slots of duration 106.7 ms (128 bits), and one signalling message can be sent in each slot. The basic control channel signalling structure is illustrated in Figure 1-1.

Signalling on the forward channel (base station transmit frequency) is nominally continuous, with each slot comprising two 64-bit codewords, usually:

i) A Control Channel System Codeword (CCSC).
The CCSC identifies the system to radio units and provides synchronisation for the following "address" codeword.

ii) An "address" codeword.
An address codeword is the first codeword of any message, and defines the nature of the message.

Both the CCSC and address codewords are displaced when the Trunking System Controller (TSC) transmits longer messages, with "data" codewords appended to an address codeword.

A radio unit can receive a message from the TSC in one slot, transmit a response in the next slot and then retune to the forward channel in time to decode the following message from the TSC. (In Figure 1-1, the response is shown aligned with the outbound message; however, there are tolerances on the timing.)

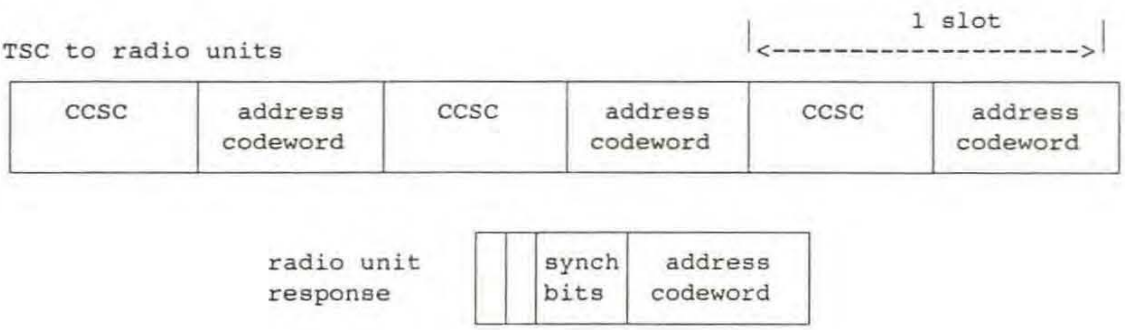


Fig. 1-1 Control channel signalling structure

1.3.2 Control channel signalling messages

The messages sent on a control channel may be classified as follows:

Aloha messages	- Sent by the TSC to invite and control random access.
Requests	- Sent by radio units to request calls/transactions.
"Ahoy" messages	- Sent by the TSC to demand a response from an addressed radio unit.
Acknowledgements	- Sent by the TSC and by radio units.
Go To Channel messages	- Sent by the TSC to allocate traffic channels.
Single address messages	- Currently sent only by radio units.
Short data messages	- Sent by the TSC and by radio units.
Miscellaneous messages	- Sent by the TSC for system control.

Some uses of these messages are illustrated in the following sections.

1.3.3 Random access protocol

1.3.3.1 Principle of operation

One of the problems of mobile radio signalling schemes is the clash of messages from different radio units transmitting at the same time. In this standard, the problems of clashing are controlled by a random access protocol which is based on slotted Aloha, with a superimposed framing structure. The access protocol can be used to minimise access delays, ensure stability and maintain peak throughput under heavy traffic loads.

The basic principle of the access protocol is described with reference to Figure 1-2, which illustrates signalling on a control channel. The TSC transmits a synchronisation message (indicated by ALH in Figure 1-2) to invite radio units to send random access messages. The ALH message contains a parameter (N) which indicates the number of following timeslots, constituting a frame, that are available for access. If a frame is already in progress when a user initiates a call, the radio unit may send its random access message in the next slot. Otherwise the unit waits for a frame to be started and then chooses a random slot from the frame for its message. A unit wishing to send a repeat transmission after an unsuccessful message (corrupted by fading or clashing) chooses again from a new frame.

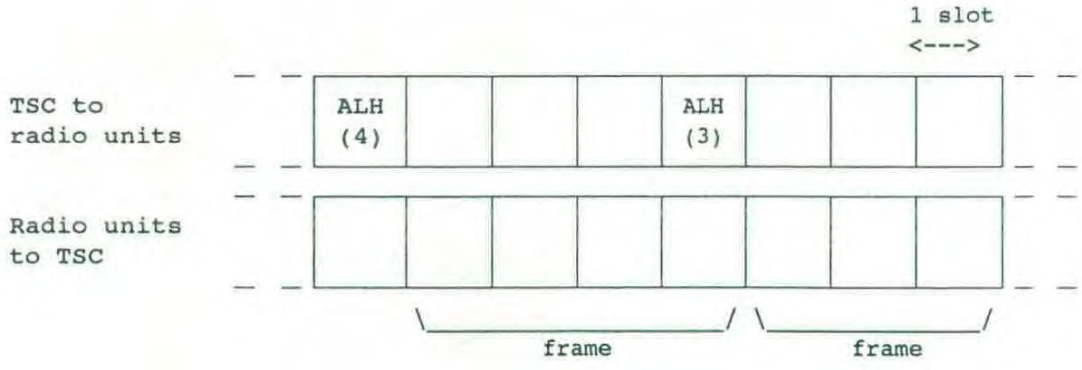


Fig. 1-2 Two random access frames, each marked by an ALH message

1.3.3.2 Features of the random access protocol

The main features of the access protocol are as follows:

a) The TSC can monitor activity on the control channel and can optimise the system performance by varying the framelength to prevent excessive clashing and to minimise access delays. Figure 1-3 illustrates an example of random access control.

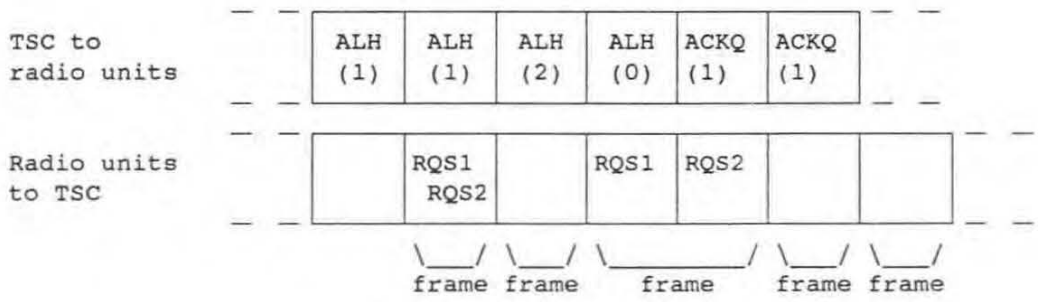
b) The signalling overhead for random access control is kept small by allowing Acknowledgements and Go To Channel messages to contain the framelength parameter (N), so that frames can be marked without requiring an explicit Aloha message. For example, see Figure 1-3.

c) During a frame, the TSC may transmit messages that demand a response from a specified radio unit. These outbound messages inhibit random access in the following slot, and so reserve the slot for the unit's reply.

d) The TSC may reserve frames for:

- specific types of call request, by means of specific Aloha messages (for instance, the Aloha message ALHE invites emergency calls only);

- subsets of the radio unit population (subdivision by address).



The TSC detects the clashing of requests RQS1 and RQS2, and marks a longer frame (with message ALH(2)). The radio units repeat their requests and, in this example, choose different slots. Each request is acknowledged in the following slot.

ALH(0) does not mark a frame.

ACKQ(1) acknowledges a request and also marks a new frame.

In the absence of clashing, the framelength may be reduced.

Fig. 1-3 Example of random access control

1.3.4 Addressing

A unit address is a 20-bit number comprising two fields: a 7-bit prefix and a 13-bit ident. (Normally, all members of a fleet will be allocated the same prefix.) The division into prefix and ident allows most messages to accommodate two addresses, the calling and called party, by including the prefix only once. For instance, call requests and Go To Channel messages contain two idents and only one prefix.

For a call to a unit with the same prefix, a request message contains all the information necessary to make the call. However, for a call to a unit with a different prefix, the call details cannot be accommodated in a single address codeword; this type of call requires the use of "extended addressing" procedures (as do some PABX and most PSTN calls).

1.3.5 Examples of signalling sequences

The precise signalling required for a call depends on the type of call and on the design of the TSC; (the standard does not prescribe the TSC algorithms). This section contains some examples of message exchange sequences. Note that, although not shown in the examples, messages will be retransmitted in the case of corruption by propagation errors or collision.

Examples of message exchange sequences for call set-up are presented in sections 1.3.5.1 to 1.3.5.3. These examples show control channel signalling, for:

- call requests
- instruction to send extended address information
- checking availability of radio units
- traffic channel allocation.

Signalling is also sent on an allocated traffic channel, for call maintenance and call clear-down. For instance:

a) To assist call maintenance, a radio unit sends a "Pressel Off" message at the end of each speech transmission. The system may also require the unit to start each speech transmission with a "Pressel On" message and to send call maintenance messages periodically within the transmission.

b) The calling unit in a group call, or both units in an individual call, send "Disconnect" messages to indicate end-of-channel-use when the user goes on-hook or equivalent.

c) The TSC sends CLEAR messages to clear down a call (after receiving a valid Disconnect message or if a time-out has expired).

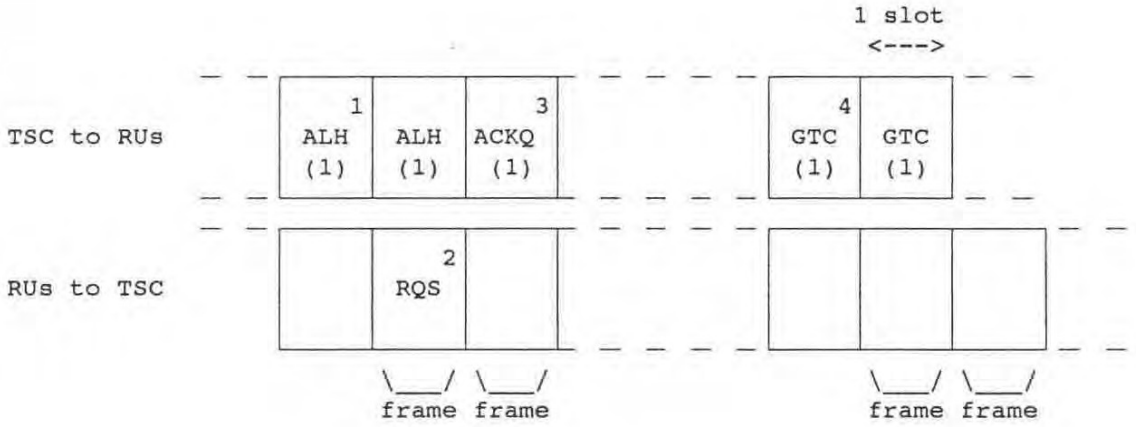
However, the examples do not cover traffic channel signalling.

The final example (section 1.3.5.4) illustrates the transmission of a short data message. This type of transaction does not use a traffic channel: it requires control channel signalling only.

1.3.5.1 Example: radio unit calls a group

Figure 1-4 illustrates a message sequence on a control channel to set up a group call between radio units with the same prefix.

The sequence includes call request and channel allocation signalling. (For group calls, an availability check on the called units is not performed.) In this example, all traffic channels are in use when the call is requested and so the call is queued.



1. ALH : General Aloha invitation (one-slot frame).

2. RQS : The calling radio unit transmits its request, complying with the random access protocol.

3. ACKQ : The TSC acknowledges the RQS message, informing the calling unit that the call has been queued.

4. GTC : When a traffic channel is available, the TSC sends the Go To Channel command, addressed to the calling unit and called group; this message instructs the units to switch to the traffic channel for their conversation. In this example the GTC is repeated, for added reliability.

Fig. 1-4 Common-prefix group call

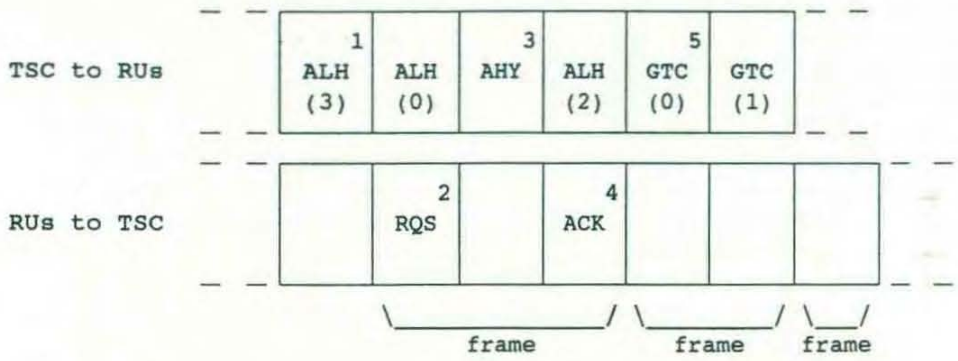
Alternative acknowledgements from the TSC are available if, for instance, the call request is invalid or the system is overloaded.

If a traffic channel is available when a group call is requested then the TSC may omit the ACKQ and send the GTC command immediately.

In this example the GTC message is repeated immediately. However, repeat messages may be delayed for other signalling.

1.3.5.2 Example: radio unit calls a unit with the same prefix

Figure 1-5 illustrates a message sequence on a control channel to set up a call between two radio units with the same prefix. The sequence includes call request, availability check and channel allocation signalling.



1. ALH : General Aloha invitation (three-slot frame).

2. RQS : Random access call request.

3. AHY : Availability check message
   - acknowledges the RQS message
   - demands a response from the called radio unit (thereby checking whether the called unit is in radio contact)
   - inhibits random access in the next slot.

4. ACK : Acknowledgement from the called radio unit, sent in the reserved slot.

5. GTC : Go To Channel message instructing both radio units to switch to the specified traffic channel for their call. In this example the GTC is repeated, for added reliability.

Fig. 1-5 Common-prefix individual call

In this example, the called unit is in radio contact and therefore responds to the AHY. If the called unit cannot be contacted, the TSC may indicate the failure to the calling unit by sending acknowledgement ACKV.

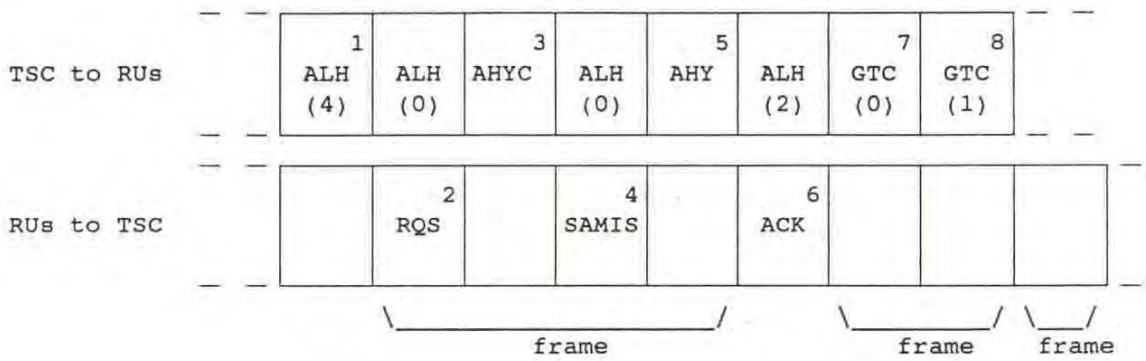
In both this and the following example, the TSC checks only that the called unit is in radio contact before allocating a traffic channel. The TSC may also check whether the called user is ready; if he is not, the unit responds with acknowledgement ACKI and takes action to alert him. Then, when the user is ready to receive the call, the unit may send a status message (RQQ) to inform the TSC.

The ALH(0) message in these examples is used as a "dummy" message, in slots carrying no signalling relevant to the example. In practice, these slots may be used for signalling for another call, or for broadcast messages (which contain information about system parameters).

1.3.5.3 Example: radio unit calls a unit with a different prefix

Figure 1-6 illustrates a message sequence on a control channel to set up a call between two radio units with different prefixes.

The sequence includes call request, availability check and channel allocation signalling (as in the previous example). However, this sequence has an extra phase: after receiving the RQS message, the TSC sends AHYC to invite the calling unit to transmit the full called address. Also, separate GTC messages instruct the two units, because GTC contains only one prefix.



1. ALH : General Aloha invitation (four-slot frame).

2. RQS : Random access request for an interprefix call. (The request contains the calling unit's address (prefix/ident), but the called ident is set to a special "gateway" ident to indicate that extended addressing procedures are needed.)

3. AHYC : Short data invitation message
   - acknowledges the RQS message
   - instructs the calling unit to send the called address
   - inhibits random access in the next slot.

4. SAMIS : Single Address Message from the calling radio unit, containing the address (prefix/ident) of the called unit.

5. AHY : Availability check message demanding a response from the called radio unit. In this example, the availability check is a single-codeword message i.e. the address of the calling unit is not supplied.

6. ACK : Acknowledgement from the called radio unit.

7. GTC : Go To Channel message instructing the called radio unit to switch to the specified traffic channel for the call.

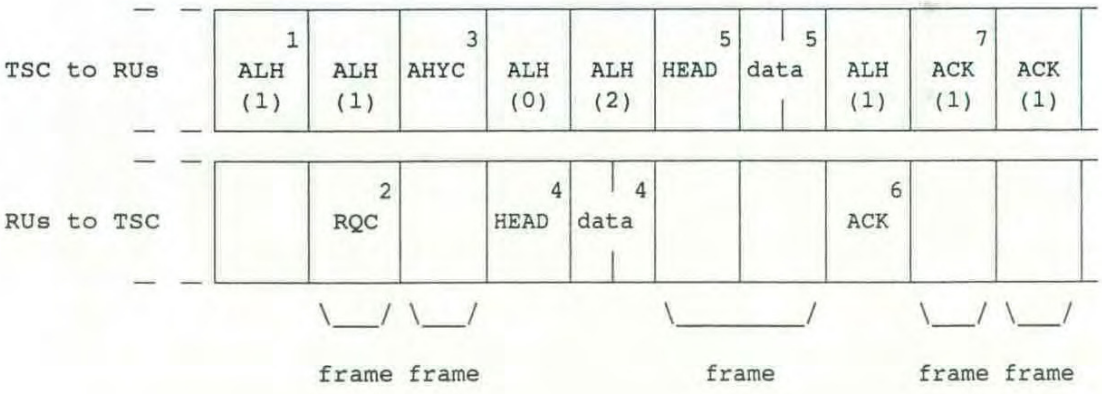
8. GTC : Go To Channel message instructing the calling radio unit to switch to the specified channel for the call.

Fig. 1-6 Interprefix individual call

1.3.5.4 Example: radio unit sends a short data message

Figure 1-7 illustrates a message sequence on a control channel for sending a short data message from one radio unit to another radio unit. In this example, the data message comprises an address codeword and two appended data codewords; (each of the data codewords contains 46 bits of free format data).

In the sequence, the radio unit sends its request; the TSC instructs the unit to send the data message, forwards the data message to the called unit and then indicates the success of the transaction to the calling unit.



1. ALH : General Aloha invitation (one-slot frame).

2. RQC : Random access request to transmit a short data message. (The request indicates the number of timeslots required for the data message: in this case, two slots.)

3. AHYC : Short data invitation message
   - acknowledges the RQC message
   - instructs the calling unit to send the data message in the next two slots.

4. HEAD + data : The calling radio unit sends its short data message to the TSC. In this example the message comprises an address codeword (HEAD) and two appended data codewords.

5. HEAD + data : The TSC forwards the short data message to the called radio unit.

6. ACK : Acknowledgement from the called unit - message accepted.

7. ACK : Acknowledgement sent to the calling unit to indicate that the called unit has accepted the data message. In this example the TSC immediately repeats the ACK message, for added reliability.

Fig. 1-7 Short data message

2. DEFINITIONS

Note - Words appearing within asterisks within these definitions are defined terms. (eg *defined term*)

Active on a Channel: A *radio unit* is *active on a channel* when, on that channel, it is enabled to respond to *messages* addressed to it, or is transmitting, or is in transition between these two states.

Note - a *radio unit* becomes active on an assigned *traffic channel* as soon as it can receive on that channel, whereas, on a *control channel* it shall not become active until it has received a codeword containing an appropriate *system identity code*.

Address: A 20-bit number by which a unit or group of units is known within a *system*. The *address* comprises two *fields*; a 7-bit *prefix* and a 13-bit *ident*.

Address Codeword: A 64-bit codeword, conforming to the requirements of this standard, where the first bit is set to '1'. An *address codeword* is always the first codeword in any *message*, and defines the nature of the *message*.

Base Station: The entirety of transmitters and receivers operated by a *trunking system controller* at any one site.

Call: A complete information exchange between two or more *parties* which includes one or more *transactions* and may include direct user-to-user communication on a *traffic channel*.

Called Unit (or Group): The unit, or group of units, which a *calling unit* identifies as the desired recipient(s) of a *call*. The *called unit (or group)* retains this designation for the duration of a *call* and this convention is used in *messages* relating to that particular *call*, irrespective of the origin of such *messages*.

Calling Unit: A *radio unit* or *line unit* which request a *call*. The *calling unit* retains this designation for the duration of a *call* and this convention is used in *messages* relating to that particular *call* irrespective of the origins of such *messages*.

Common Prefix Call: A *call* where the values of the *prefixes* in the calling and called *addresses* are the same. *Common prefix calls* use the *short addressing* procedures.

Control Channel: A *forward channel* and *return channel* being used for the transmission of *messages* conforming to this standard with the primary purpose of enabling the *trunking system controller* to control radio units.

Data Codeword: A 64-bit codeword, conforming to the requirements of this standard, where the first bit is set to '0'. *Data codewords* are concatenated to an *address codeword* and supplement the information in the *address* codeword*.

Dataitem: The whole, or a part of, a *Tmessage*. A dataitem may not include more than 62 data codewords.

Decodeable: A transmitted codeword shall be considered *decodeable* if, after receipt, and after any error correction (if used) has been applied, a valid codeword from the code defined in section 3.2.3 of this standard is formed.

Diversion: A procedure whereby a *party* may request that future *calls* to a particular called address be redirected to an alternative destination.

Extended Addressing: A method which allows called *party* details to be conveyed to the *trunking system controller* when the *call* details cannot be accommodated in a single *address codeword*. These called-party details may be an *address* or addressing information in a different form (eg PSTN dialling digits).

Field: A number of contiguous bits in a codeword which is specified in terms of the position within the codeword and the number of bits.

Forward Channel: A radio bearer where the direction of transmission is form the *base station* to *radio units*.

Fragment: A message which is either the whole of a *dataitem* or those codewords of a *dataitem* for which repetition has been requested by the receiving station.

Free Format Data: Data within a codeword which, in this standard, is constrained only by its position and length.

Gateway: A *special ident* which is used to identify a *message* relating to a *call* or *transaction* to or from a communications service outside of the *system* (eg the PSTN). For the purposes of this standard the interprefix *ident*, IPFIXI, is also regarded as a *gateway*.

Group Address: An *address* which is common to more than one unit and which, when nominated as the called *address*, signifies a *group call*. Units may be assigned any practicable number of *group addresses*.

Group Call: A *call* in which a *group address* is specified as the called *party* and, accordingly, provides a means of communication between more than two units. The calling *party* in a *group call* may opt for a conversational mode, where all *parties* are able to speak, or for an announcement mode where only the caller may speak.

Ident: A 13-bit number used for identification purposes. Values of *ident* between 1 and 8100 inclusive are assigned to individual units or groups, in which case they are associated with a *prefix* to form a 20-bit *address*. Values of *ident* above 8100 are designated *special idents* and these are not associated with any particular *prefix*, neither is the *ident* value 0 (DUMMMYI).

Idle State: A *radio* unit* is in the *idle state* on a *system* when it is *active on a control channel* belonging to that *system*, is not currently within a *message* exchange and has no current *message* transfer requirement.

Include: A procedure whereby *parties* may be introduced into a *call* in progress at the request of an existing *party* to the *call*.

Individual Address: An *address* by which a single unit is known within a *system*, allowing that unit to be uniquely addressed by that *system*. Units may be assigned any practicable number of *individual addresses* provides that at least one per *systems* is assigned to each unit.

Individual Call: A *call* between a calling *party* and a single called *party*.

Interprefix Call: A *call* where the values of the *prefixes* in the calling and called *addresses* are different. *Interprefix calls* require *extended addressing* procedures.

Invoking message: A message from the TSC to a radio unit which requires or invites an immediate message from the radio unit according to the timing rules specified in section 6 if the transmission rate is 1200 bit/sec or the equivalent rules at any other transmission rate.

Item: A complete user transmission on a *traffic channel* by one *party* within a *call* at the conclusion of which that *party* rests from transmission. It is possible for a *call* to contain only one *item*.

Line Unit (LU): A user station which is allocated an *individual address*, and is directly connected to the *trunking system controller* via a medium other than the radio spectrum to which this standard applies.

Link: Any transmission path in the communication chain between the end users in a Standard Data call, and particularly the radio connection between the TSC and its dependent radio unit in such a call.

Message: A single contiguous data transmission which consists of a codeword synchronisation sequence, an *address codeword* and (optionally) one or more *data codewords* conforming to this standard.

Non-prescribed data: Any data traffic which does not conform to the data protocols defined in this standard.

Party: A source and/or recipient of information within a *call*. The term includes the totality of equipment at the user station and, where the context permits, the equipment user. A party may be an individual or a group.

Prefix: The 7 most significant bits of an *address*. Normally units within a fleet will be allocated the same *prefix* since

calls between units and groups with the same *prefix* can be made without the use of *extended addressing* procedures. A *prefix* is only relevant to *individual addresses* and *group addresses*.

Radio Unit (RU): A mobile or other user station contacting a *system*, by normal land mobile radio in accordance with this standard.

Random Access Attempt: The method by which a *radio unit* transmits an unsolicited *message* to the *trunking system controller* on a *control channel*. The method requires that a *radio unit* repeats a random access *message* if a response *message* is not received within a designated waiting time. Further repeats are required, in the absence of an appropriate acknowledgement, until a designated number of repeats is reached. In this standard a *random access attempt* covers the period from initiation of the *transaction* to the receipt of an appropriate acknowledgement or the expiry of a timeout.

Ready-for-Communication Control (RFCC): A device or system to inform a unit of the user's readiness to communicate, eg a switch-hook.

Registration: A procedure which confirms that a *radio unit* is within a *session* on a *system*. The *registration* procedures may be initiated by a demand from the *trunking system controller*, or at the initiative of the *radio unit*, depending on the circumstances of the *registration*.

Requested Unit (or Group): A unit, or group of units, which takes part in a *transaction* initiated by the *trunking system controllers* or another *party*.

Requesting Unit: A *radio unit* or *line unit* which initiates a *transaction* with the *trunking system controller* or another *party*, via the *trunking system controllers*.

Reserved: Codewords and *fields* which are designated as *reserved* in this standard are intended for future phases of standardisation and shall not be used in the interim for the conveyance of information. *Reserved fields* must be set to the default value specified in this standard.

Return Channel: A radio bearer where the direction of transmission is from *radio Units* to the *base station*.

Session: A *session* is a period of operation associated with one *system*. A *session* on a *system* starts when the *radio unit* becomes *active on a control channel* of that *system*, either after switch-on or after being *active on a control channel* of a different *system*. A *session* ends either when the *radio unit* is switched off or when it starts its next *session*.

Short Addressing: The method used when the *parties* to a *call* can be completely specified by a single *prefix* and two *idents*. This form of addressing minimises the signalling required.

Short Data: A procedure which allows a data *message* to be exchanged between *parties*, or between *parties* and the *trunking system controller*. This procedure does not support *messages* which include more than four *data codewords*.

Short-Form PSTN Destination: A called PSTN *party*, previously agreed between the system operator and the user of the *calling unit*, which can be specified by a *special ident*, rather than the full stream of dialling digits representing the directory number.

Spare: Codewords and *fields* which are designated as *spare* are available for free use by *systems* (ie *system* customisation) provided that the conditions of this standard are not infringed. The use of spare codewords and *fields* may vary from *system* to *system*.

Special Ident: An *ident* with a value greater than 8100. These *idents* are used for a variety of special purposes. Some of these are specified in this standard, others may be nominated by system operators. *Special idents* are not associated with a *prefix* to form an *address*.

Standard Data: The procedure by which information exchange takes place using the data protocol defined in section 17 of this standard.

System: The totality of equipment required to provide the communication facilities associated with a single *system identity code*. *Systems* may be combined to form larger communications facilities, but the delineation of *systems* and methods of combination are not within the scope of this standard.

System Identity Code: A 15-bit number which contains a unique identification of a *system*. This code is radiated on each *forward control channel* within the *system* (in the SYS *field*).

Tmessage: A quantity of *user data* which the correspondents by previous bilateral agreement have mutually agreed is useful to them as a distinct entity, and is marked as such by the originator for end-to-end transmission.

Traffic Channel: A *forward channel* and *return channel* being used primarily for user communication.

TRANS: A 10 bit transaction number allocated to a *link* during set-up of a data call to replace the address and port of the radio unit. The validity of a TRANS ceases at the conclusion of the data call.

Transaction: A complete information exchange consisting of one or more *messages* between a *party* and the *trunking system controller*, or another *party*, via the *trunking system controller*.

Trunking System Controller (TSC): The central control intelligence necessary to enable the trunking system to function according to this standard. The *trunking system controller* may control one or more *basestations*.

User Data: Data from or to the user which is either to or from his correspondent, or is concerned with call routing but is transmitted after a *TRANS* for the call has been allocated.

User Data Message: A message headed by address codeword "SITH" and containing user data.

3. SIGNALLING FORMATS

This section defines the basic signalling formats used by this standard. The detailed structure of the codewords is defined in section 5, and the timing constraints for the transmission of messages are defined in section 6.

The provisions of this section do not preclude the use of other, non-prescribed formats on a traffic channel.

3.1 Basic Format

Signalling transmissions shall employ Fast Frequency Shift Keying (FFSK) at a bit rate of 1200 bit/s. The basic components of the signalling formats are illustrated in Figure 3-1.

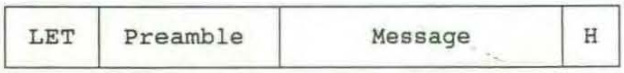


Fig. 3-1. Basic format

3.1.1 LET

Signalling transmissions shall be preceded by a Link Establishment Time (LET) within which a transmission of undefined modulation at not less than 90% of maximum power shall take place. The duration of the LET shall be as specified in section 3.3.3.1 and section 6.

3.1.2 Preamble

Signalling transmissions shall begin with a preamble of bit reversals 1010...10 so that the receiver data demodulator can acquire bit synchronisation. The preamble shall consist of a minimum of 16 bits and shall end with a binary zero.

3.1.3 Message

A message is a contiguous transmission consisting of a codeword synchronisation sequence, an address codeword and, where appropriate, one or more data codewords (see 3.2).

3.1.4 Hang-over Bit, H

Signalling transmissions shall be terminated by appending a "hang-over" bit of either binary zero or binary one to the last transmitted message.

3.2 Message Format

A message consists of a codeword synchronisation sequence, an address codeword and, where appropriate, one or more data codewords, as shown in Figure 3-2. The address codeword defines the nature of the message, and data codewords supplement the information in the address codeword.

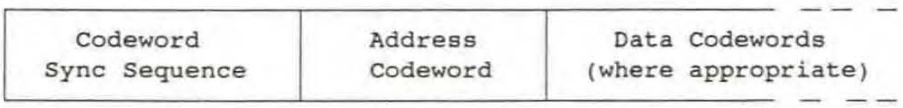


Fig. 3-2. Message format

3.2.1 Codeword synchronisation sequence

The codeword synchronisation sequence shall be transmitted to enable decoders to establish codeword framing. It consists of 16 bits.

3.2.1.1 Control channel codeword synchronisation sequence

The codeword synchronisation sequence for messages transmitted on a control channel, SYNC, is shown in Figure 3-3. Bit number 1 shall be transmitted first.

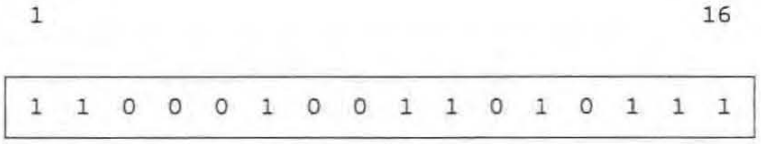


Fig. 3-3. Control channel codeword synchronisation sequence, SYNC

3.2.1.2 Traffic and Standard Data channel codeword synchronisation sequence

The codeword synchronisation sequence for messages transmitted on a traffic or standard data channel, SYNT, is shown in Figure 3-4. Bit number 1 shall be transmitted first. If a control channel is allocated for traffic, then SYNT shall be used for all messages transmitted while the channel is assigned for traffic.

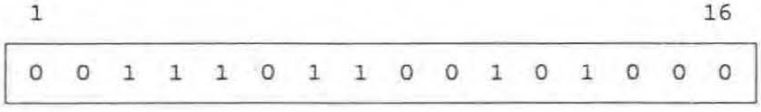


Fig. 3-4. Traffic and Standard Data channel codeword synchronisation sequence, SYNT

3.2.2 Codewords

Messages shall be transmitted in 64-bit codewords. Each codeword shall contain 48 information bits followed by 16 check bits. There are two types of codeword, address and data codewords, which are distinguished by the first bit (A) within the codeword; see Figure 3-5. Bit number 1 shall be transmitted first.

bit no.	1	2 ... 48	49 ... 64
	A	information field	check bits
no. of bits	1	47	16

Bit 1 (A) - Binary one denotes an address codeword.
Binary zero denotes a data codeword.

Bits 2 to 48 - Information field; see section 5.

Bits 49 to 64 - Check bits; see section 3.2.3.

Fig. 3-5. Codeword structure

3.2.3 Encoding and error checking

The first 15 check bits are derived from a (63,48) cyclic code. For encoding, the codeword bits 1 to 48 represent the coefficients of a polynomial having terms from X^{62} down to X^{15}. This polynomial is divided modulo-2 by the generating polynomial:

$$X^{15} + X^{14} + X^{13} + X^{11} + X^{4} + X^{2} + 1$$

The 15 check bits correspond to the coefficients of the terms from X^{14} to X^{0} in the remainder polynomial found at the completion of the division. The final check bit of the (63,48) cyclic code (codeword bit 63) is then inverted. Finally, one bit is appended to the 63-bit block (including the inverted bit number 63) to provide an even parity check of the whole 64-bit codeword.

Decoding algorithms are not prescribed in this standard; for the error control properties of the codeword, see Appendix 2.

3.3 Signalling Transmission Variants

3.3.1 Single message format

The format for signalling transmissions which contain a single message is shown in Figure 3-6.

Fig. 3-6. Single message format

3.3.2 Multiple message format on a traffic channel

The format for standardised signalling transmissions which contain more than one message is shown in Figure 3-7. This format shall be used only on traffic channels.

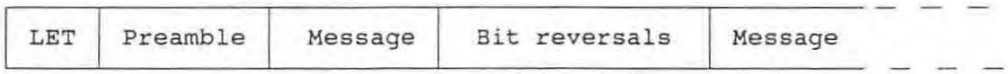


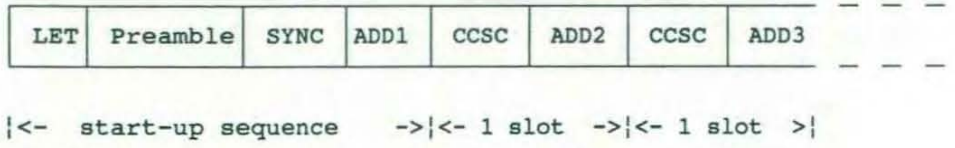
Fig. 3-7. Multiple message format

For multiple messages transmitted by a radio unit, there shall be 16 bits of bit reversals between messages. For multiple messages transmitted by the TSC, bit reversals may be inserted between the messages as required. The final bit of any bit reversals (before the next message) shall be a binary zero.

3.3.3. Forward control channel format

3.3.3.1 Basic control channel format

The start-up sequence for a base station commencing transmission on a control channel shall be as shown in Figure 3-8.



LET - Link establishment time of at least 6 bit periods (5 ms).

Preamble - At least 16 bits of bit reversals, ending with a binary zero.

SYNC - Control channel codeword synchronisation sequence; see 3.2.1.1.

ADDn - Address codeword (any appropriate message); see section 5.

CCSC - Control Channel System Codeword; see 5.1.

Fig. 3-8. Basic control channel format

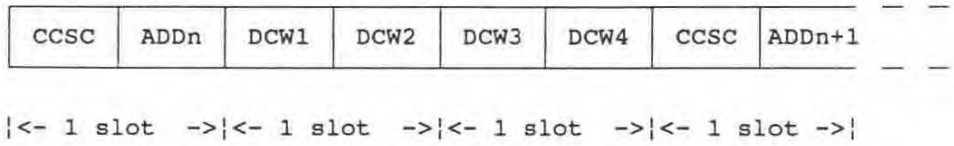
Following the start-up sequence the TSC shall divide time into slots, each comprising two codewords. The first codeword of a slot shall be the Control Channel System Codeword (CCSC), unless displaced by a data codeword from a previous message. The second codeword of a slot shall be an address codeword, unless displaced by a data codeword (see 3.3.3.2).

Every address codeword in a slot shall be preceded by a CCSC. The CCSC identifies the system to radio units and provides control channel slot synchronisation. It is a data codeword in which the final 32 bits form the preamble and codeword synchronisation sequence for the following address codeword (see 5.1).

The MARK address codeword (see 5.5.4.1) may be transmitted by the TSC on a newly designated control channel during the period allowed for radio units to locate and identify the control channel (see 6.1.1).

3.3.3.2 Data codeword displacement

When data codewords are transmitted as part of a message, they displace CCSCs and address codewords, as illustrated in Figure 3-9. Radio units must be capable of satisfactory operation despite this displacement (see section 6). The TSC shall not displace more than two CCSCs in consecutive timeslots.



CCSC - Control Channel System Codeword.
ADDn - Address codeword (any appropriate message).
DCWm - Data codeword in message.

Fig. 3-9. Example of data codeword displacement

When a message includes an odd number of data codewords, a "filler" data codeword shall be appended to the message (to maintain the slot structure); the content of the filler data codeword is not prescribed in this standard. See also section 7.2.5.

4. ADDRESSING

The unit address enables the TSC to recognise the source of messages and/or to direct messages to a particular unit or group of units. In addition, addresses may be used by the TSC to regulate access to the system.

This standard permits considerable flexibility in the way that unit addresses can be allocated, allowing each system full use of all available addresses. However system operators shall not allocate addresses in such a way that two units, using the same individual address, could be active on a system concurrently. Further, this standard does not support address reuse within interconnected systems.

The protocol allows over 32000 system identity codes and over one million addresses. A unit may be allocated different addresses for each system within which it is required to operate, or its addresses can be common to more than one system.

Unit addresses can be used for individual units or for groups of units. A group can be formed by allocating a common address to all members of the group. All units shall have at least one individual address.

Individual and group addresses consist of a 7-bit prefix and a 13-bit ident. Normally units within a fleet will share a common prefix, since this allows the short addressing procedures to be used during call set-up. Idents allocated to units must be equal to the binary equivalent of decimal numbers in the range 1 to 8100, inclusive.

The ident value 0 shall not be allocated to any unit and is designated the "dummy" ident, DUMMYI; this ident may be used as a null value.

Values of ident above 8100 are designated special idents and are not available for allocation to units. Use of these special idents allows a number of additional procedures and facilities to be achieved within this protocol standard. Some special idents are designated as gateways. These are used for calls which involve connection to communication facilities external to the system.

The arrangement of idents is summarised in Table 4-1.

Ident number 0 and special idents do not have a prefix associated with them; the prefix is only relevant to individual unit and group addresses.

The system-wide all-call ident applicable to all units (irrespective of prefix) is denoted by ALLI. The individual ident of the Trunking System Controller (TSC) is denoted by TSCI; this ident is the same for all TSCs.

Special idents are also employed within certain call procedures described in this standard. These include:

	SDMI:	which is used in the short data message procedures;
	DIVERTI:	which is used during call diversion procedures;
	INCI:	which is used by the TSC when checking the availability of a unit requested to be included in a call;
and	REGI:	which is used by the TSC in the registration procedures.

Two methods, both of which employ gateway idents, are provided for radio units requesting calls to the PSTN, namely:

- "short-form" calls, to destinations previously nominated (eg the radio unit's head office).
- "general" calls, to any PSTN destination.

Radio units requesting calls to prearranged PSTN or Data Network destinations use the short addressing procedures, with the called ident set to an appropriate "short-form" PSTN or Network ident. These short-form idents are denoted by PSTNSIj or NETSIj respectively, for j = 1 to 15. PSTNSIj is used for all appropriate call requests except RQD, and NETSIj is only used in RQD call requests. Each short-form ident allocated to a radio unit shall represent a complete destination previously agreed between the system operator and the radio user. A particular short-form ident may be reused for other radio units, each use having a distinct meaning. Thus, when a short-form call is requested, the TSC shall determine the meaning of the particular short-form ident by reference to the calling radio unit's address. The same principle can be applied to incoming calls.

Radio units requesting a "general" PSTN call use the gateway ident, PSTNGI. In this case, units are required to provide the full dialling information for the PSTN destination using the extended addressing procedures described in this standard.

Radio units requesting a "general" data network call use the gateway ident, DNI. In this case units will be allocated a data channel and TRANS. After this they supply the network addressing information on the data channel in a format appropriate to that network.

Radio units can request calls to PABX extensions using the short addressing procedures, provided that the extension number can be represented by 13 bits. A call may be to any one of four PABX exchanges, as previously agreed between the system operator and the radio use - the TSC shall determine the appropriate exchange by reference to the calling radio unit's address. Calls to PABX destinations that cannot be accommodated by the short addressing procedures use the PABX gateway ident, PABXI, and the extended addressing procedures.

Calls between units which do not share a common prefix also require use of the extended addressing procedures. For such calls the appropriate special ident is IPFIXI.

Meaning	Notation	Ident	
System-wide ident	ALLI	8191	
Ident of TSC	TSCI	8190	
Interprefix ident	IPFIXI	8189	
Short data message ident	SDMI	8188	
Divert ident	DIVERTI	8187	
Include ident	INCI	8186	
Registration ident	REGI	8185	
Reserved for future allocation		8181 - 8184	
Spare for customisation of systems		8136 - 8180	
Short-form PSTN idents	PSTNSIj	8121 -8135}	Note:Common
Short-form data Network idents (j = 1 ... 15)	NETSIj	8121 -8135}	range.
Reserved for future allocation		8104 - 8120	
Data Network gateway ident	DNI	8103	
PABX gateway ident	PABXI	8102	
General PSTN gateway ident	PSTNGI	8101	
User idents (individual and group idents)		1 - 8100	
Dummy ident	DUMMYI	0	

Table 4-1 - Ident Numbering Scheme

5. CODEWORD STRUCTURES

This section lists the codewords used in the standardised messages and defines their structure. A brief indication of the usage of the messages is given, but readers should refer to the procedures sections for a full definition of usage. Readers may find it helpful to study the procedures sections together with this section rather than consecutively.

It is not a mandatory requirement on either a TSC or a radio unit to understand the meaning of all the standardised messages. The messages that must be used will depend on the facilities implemented in a TSC and a radio unit; the procedures sections define which messages are required.

Standardised fields

The codewords are shown broken down into their constituent fields, with a definition of the meaning of each field. The fields in the codewords shall be set to appropriate values. Machine transmission of fields is most significant bit first.

In this standard, the numerical value of a field is referred to either by the decimal equivalent of the bit sequence concerned, with leading zeros suppressed, or in binary. Binary values are shown enclosed in apostrophes, e.g. Type '11', except in the codeword diagrams in this section.

Most address codewords contain a prefix and either one or two idents. When the prefix is not required to complete an address (e.g. for special ident ALLI), it may be set to an arbitrary value and, on reception, its value shall be considered to have no significance.

Reserved fields

Some fields are designated as "reserved". In the future development of this standard, the whole or any part of a reserved field may be designated for a specific purpose. Any such designation will be made in a manner that does not cause any existing application of this standard to cease to comply with the standard or to suffer a reduction in its functionality. Neither the existing protocol procedures nor the already designated meanings of messages will be changed in order to bring a reserved field into service.

Therefore, equipments complying with this issue of the standard shall, on transmission, set reserved fields to the specified default value and, on reception, shall consider the value of reserved fields to have no significance. Equipments which understand the designation of any previously reserved field shall, on transmission, note that the recipient equipment may attribute no significance to that field or, on reception, shall be prepared to accept the default value of that field.

Spare fields and codewords

There are "spare" fields and codewords available for customisation of services (see section 5.2). Spare fields and codewords will never be used within this standard, but may be designated for a specific purpose within any given application of this standard. In applications where spare fields or codewords are employed, rules shall be generated governing their use. Any designation of spare fields and codewords shall not modify the meaning of standardised fields and codewords.

Unless a radio unit knows the meaning of spare fields and codewords on the system it is currently using, it shall not transmit spare messages to the TSC, nor take any action on receiving spare messages from the TSC, nor use the spare fields in standardised messages received from the TSC.

5.1 System Codewords

5.1.1 Control Channel System Codeword (CCSC)

The Control Channel System Codeword is transmitted on a control channel by a TSC in order to identify the system to radio units and to provide control channel slot synchronisation (see section 3.3.3). It is a data codeword, structured as shown below.

	0	SYS	CCS	PREAMBLE 1010101010101010	P 1100010011010111
no. of bits	1	15	16	16	16

SYS - System identity code of the transmitting system. Values of SYS which result in production of the control channel codeword synchronisation sequence, SYNC, in any part of the 48 information bits of the CCSC are not permitted.

CCS - Codeword Completion Sequence, chosen so that the parity check bits P always form the control channel codeword synchronisation sequence. The bit values of the CCS will depend on the system identity code; an algorithm for generating the CCS is given in Appendix 3.

PREAMBLE - Preamble bit reversals, ending with a '0'.

P - Parity check bits. These complete the codeword and also form the control channel codeword synchronisation sequence, SYNC (section 3.2.1.1).

5.1.2 Data Channel System Codeword (DCSC)

The DCSC is transmitted on a data channel by the TSC in order to identify the system to radio unit's and to provide data channel slot synchronisation. It is a data codeword as shown below :

	0	SYS	CCS	PREAMBLE 1010101010101010	P 0011101100101000
no. of bits	1	15	16	16	16

SYS - System identity code of the transmitting system. Values of SYS which result in production of the data channel codeword synchronisation sequence, SYNT, in any part of the 48 information bits of the DCSC are not permitted.

DCS - Data-codeword Completion Sequence, chosen such that the parity check bits form the data channel sychronisation sequence (SYNT). An algorithm for determining the codeword completion sequence (DCS) of a data channel system codeword (DCSC) is given in appendix 3.

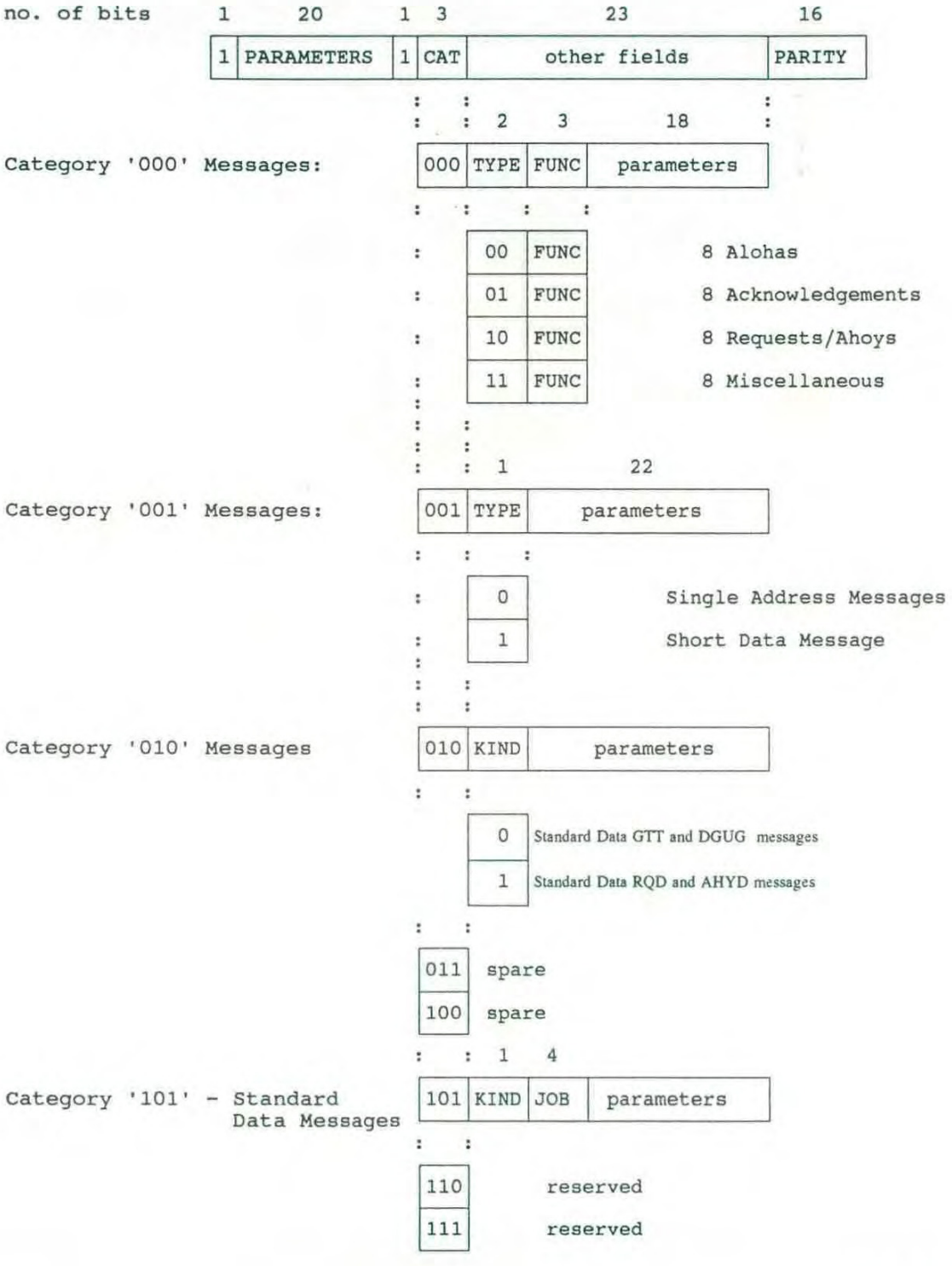
PREAMBLE - Preamble bit reversals, ending with a '0'.

P - Parity check bits.
These complete the codeword and also form the control channel codeword synchronisation sequence, SYNT (section 3.2.1.2).

5.2 General Address Codeword Structure

There is a general address codeword structure which is divided into 8 categories, and one special structure for a "Go To Channel" message (see 5.4). The general and GTC structures are distinguished by Bit 22 of the codeword; Bit 22 of the general structure is always '1' whereas Bit 22 of the GTC codeword is set to '0'.

The most usual general structure is shown below.



Categories zero and one (CAT = '000' and '001') contain standardised codewords. The "reserved" codewords are intended for future expansion of the standard message set, whereas the "spare" codewords may be used for customisation of services.

It is anticipated that reserved categories could be used for the definition of polling and data communication protocols etc. in a future phase of standardisation.

5.3 List of Address Codewords

	Mnemonic	Meaning	Section
GTC Message:	GTC	Go to channel command	5.4
CAT '000' Messages:			5.5
TYPE '00'		Aloha invitations:	5.5.1
	ALH	general	
	ALHS	standard data excluded	
	ALHD	"Simple" calls excluded	
	ALHE	emergency only	
	ALHR	registration or emergency	
	ALHX	registration excluded	
	ALHF	fall-back mode	
	reserved		
TYPE '01'		Acknowledgements:	5.5.2
	ACK	general	
	ACKI	intermediate	
	ACKQ	call queued	
	ACKX	message rejected	
	ACKV	called unit unavailable	
	ACKE	emergency	
	ACKT	try on given address	
	ACKB	call-back / negative ack	
TYPE '10'		Requests (sent by RUs):	5.5.3.1
	RQS	"Simple"	5.5.3.1.1
	RQD	standard data	5.5.3.1.2
	RQX	cancel/abort	5.5.3.1.3
	RQT	divert	5.5.3.1.4
	RQE	emergency	5.5.3.1.5
	RQR	registration	5.5.3.1.6
	RQQ	status	5.5.3.1.7
	RQC	short data	5.5.3.1.8
		Ahoys (sent by TSC):	5.5.3.2
	AHY	general availability check	5.5.3.2.1
	reserved		5.5.3.2.2
	AHYX	cancel alert/waiting state	5.5.3.2.3
	reserved		5.5.3.2.4
	reserved		5.5.3.2.5
	reserved		5.5.3.2.6
	AHYQ	status message	5.5.3.2.7
	AHYC	short data invitation	5.5.3.2.8
TYPE '11'		Miscellaneous:	5.5.4
	MARK	control channel marker	5.5.4.1
	MAINT	call maintenance	5.5.4.2
	CLEAR	call clear-down	5.5.4.3
	MOVE	move control channel	5.5.4.4
	BCAST	broadcast	5.5.4.5
	reserved		
	reserved		
	reserved		

contd.

List of Address Codewords, contd.

	Mnemonic	Meaning	Section
CAT '001' Messages:			5.6
TYPE '0'		Single address messages:	5.6.1
	SAMO	Outbound	5.6.1.1
		Inbound:	5.6.1.2
	SAMIU	inbound unsolicited	5.6.1.2.1
	SAMIS	inbound solicited	5.6.1.2.2
TYPE '1'	HEAD	Short data message	5.6.2
CAT '010' Messages:	Codewords applicable to Standard Data		5.7
Kind '1'	RQD	Request for Standard Data	5.7.1
	AHYD	Availability check	5.7.2
Kind '0'	GTT	Go To Transaction	5.7.3
	DRUGI	Radio Unit General Information	5.7.4
CAT '011' Messages:	spare		
CAT '100' Messages:	spare		
CAT '101' Messages:	Standard Data		5.8

KIND '0'

JOB	FROM TSC	FROM radio unit	
'0000'	DACK+DAL		5.8.2
'0001'	DACK+DALG		5.8.2
'0010'	DACK+DALN		5.8.2
'0011'	DACK+GO	DACK+GO	5.8.2
'0100'	DACKZ	DACKZ	5.8.3
'0101'	DACKD	DACKD	5.8.1
'1000'	DAHY	RSVD	5.8.4
'1001'	RSVD	RSVD	
'1010'	RSVD	DRQG	5.8.8
'1011'	RSVD	RSVD	
'1100'	DAHYZ	DRQZ	5.8.9
'1101'	RSVD	RSVD	
'1110'	DAHYX	DRQX	5.8.6/5.8.10
'1111'	RLA	RLA	5.8.7

KIND '1'

TASK			
'0'	SACK	SACK	5.8.11
'1'	SITH	SITH	5.8.12

CAT '110' Messages:	reserved
CAT '111' Messages:	reserved

5.4 Go To Traffic Channel Message, GTC

This message is transmitted on a control channel from a TSC to radio units. It directs the addressed radio units to switch to a designated channel and proceed with communication.

This message may also be transmitted on a traffic channel to move radio units already in communication to a replacement traffic channel. When the units have retuned to the replacement channel, communication may continue.

	1	PFIX	IDENT1	0	D	CHAN	IDENT2	(N)	P
no. of bits	1	7	13	1	1	10	13	2	16

PFIX - Unit or group prefix.

IDENT1 - Called party or gateway:
- Ident - for a common-prefix call, a call from a PABX extension or from the PSTN, or an Include call.
- Ident - for an interprefix call when the message is sent to the called party.
- IPFIXI - for an interprefix call when the message is sent to the calling party.
- ALLI - for a system-wide call.
- PABXI - for a call to a PABX extension.
- PSTNSIj - for a call to a prearranged PSTN destination.
- PSTNGI - for a call to a general PSTN destination.
- DUMMYI - for an intersite call where the calling party is active on the same control channel.

D - '0' if the addressed radio units shall unmute the audio (for speech communication).
'1' if the addressed radio units shall mute the audio (for data communication), and need not send maintenance messages within items unless required by the system by prearrangement.

CHAN - Designates the allocated channel number.

IDENT2 - Calling party or gateway:
- Ident - for a common-prefix call to a unit or group of units, a system-wide call, or a call to a PABX extension or to the PSTN.
- Ident - for an interprefix call when the message is sent to the calling party.
- IPFIXI - for an interprefix call when the message is sent to the called party.
- PABXI - for a call from a PABX extension.
- PSTNGI - for a call from the PSTN.
- INCI - for an Include call.
- DUMMYI - for an intersite call where the called party is active on the same control channel.

(N) - Aloha number.
See random access protocol (section 7).

P - Parity check bits.

5.5 Category '000' Messages

5.5.1 Aloha Messages (Type '00')

These messages are transmitted on a control channel by a TSC - see section 7. They invite radio units to transmit single codeword random access messages in the designated frame of timeslots. An Aloha message may also be used to demand a response from an individually addressed radio unit.

1	PFIX	IDENT1	1	CAT 000	TYPE 00	FUNC	CHAN4	WT	RSVD	(M)	(N)	P
1	7	13	1	3	2	3	4	3	2	5	4	16

PFIX - Prefix (see also IDENT1).

IDENT1 - PFIX/IDENT1 specifies the radio units that are invited to transmit. Only the (M) least significant bits of the 20-bit address are used; the remaining address bits may be set arbitrarily.

CAT - '000'.

TYPE - '00'.

FUNC - Specifies the function of the Aloha invitation:

'000'	ALH	Any single codeword message invited.
'001'	ALHS	Messages invited, except RQD.
'010'	ALHD	Messages invited, except RQS.
'011'	ALHE	Emergency requests (RQE) only invited.
'100'	ALHR	Registration (RQR) or emergency requests (RQE) invited.
'101'	ALHX	Messages invited, except RQR.
'110'	ALHF	Fall-back mode; messages invited only from radio units which know the fall-back method used by this system. The fall-back mode is a customised mode of operation used only in the case of equipment malfunction.
'111'	Reserved for future use.	

The rules defining the Aloha functions appropriate to customised random access messages are system-dependent.

CHAN4 - Least significant four bits of the channel number of the control channel on which the message is sent (to protect against breakthrough).

contd.

WT - Delay parameter for repeat transmissions.
See random access protocol (section 7).

RSVD - Reserved for future definition. Default value = '00'.

(M) - Address qualifier.
See random access protocol (section 7).

(N) - Aloha number.
See random access protocol (section 7).

P - Parity check bits.

5.5.2 Acknowledgement Messages (Type '01')

These messages may be sent by the TSC at various stages of call set-up, and by a radio unit in response to a TSC message that demands a reply. The meanings of these messages vary both according to the function of the messages they acknowledge, and according to the source.

The basic structure of the acknowledgements is illustrated below but, for clarity, it is shown separately for TSC source and radio unit source in subsections 5.5.2.1 and 5.5.2.2 respectively.

1	PFIX	IDENT1	1	CAT 000	TYPE 01	FUNC	IDENT2	QUAL	(N)	P
1	7	13	1	3	2	3	13	1	4	16

PFIX - Prefix.

IDENT1 - Ident of the called party or gateway.
(This is the called party or gateway in the call for which the acknowledgement is being sent.)

CAT - '000'.

TYPE - '01'.

FUNC - Specifies the function of the acknowledgement:

'000'	ACK	General acknowledgement
'001'	ACKI	Intermediate acknowledgement, more signalling to follow
'010'	ACKQ	Acknowledge, call queued
'011'	ACKX	Acknowledge, message rejected
'100'	ACKV	Acknowledge, called unit unavailable
'101'	ACKE	Acknowledge emergency call
'110'	ACKT	Acknowledge, try on given address
'111'	ACKB	Acknowledge, call-back, or negative acknowledgement.

IDENT2 - Ident of the calling party or gateway.
(This is the ident of the party or gateway that originated the call for which the acknowledgement is being sent.)

QUAL - Qualifies the function (FUNC) of the acknowledgement.

(N) - Aloha number in messages transmitted by a TSC.
Reserved in messages transmitted by radio units;
default value = '0000'.

P - Parity check bits.

5.5.2.1 Acknowledgement messages sent by the TSC

The acknowledgement messages may be sent by the TSC at various stages of call set-up (or during transactions), to indicate the progress of the call. Data codeword(s) may be appended to an ACKT address codeword to convey additional information, depending on the value of IDENT1.

Acknowledgement address codeword:

1	PFIX	IDENT1	1	CAT 000	TYPE 01	FUNC	IDENT2	QUAL	(N)	P
1	7	13	1	3	2	3	13	1	4	16

PFIX - Prefix of the calling radio unit.

IDENT1 - Called party or gateway:
- Ident - for a common-prefix call.
- IPFIXI - for an interprefix call.
- ALLI - for a system-wide call.
- PABXI - for a call to a PABX extension.
- PSTNSIj - for a call to a prearranged PSTN destination.
- PSTNGI - for a call to a general PSTN destination.
- TSCI - for an RQQ or RQC transaction with the TSC.
- DIVERTI - for general cancellation by a recipient of diversions.

In ACKT(QUAL=0), IDENT1 is the diversion ident or gateway; if IDENT1 = IPFIXI, PABXI or PSTNGI, the diversion address is given in appended data codeword(s) - see below. If a call to an individual address has been diverted to a group address, or vice versa, IDENT1 in ACKT is set to IPFIXI and the diversion address is given in an appended data codeword (with bit GF set appropriately).

In acknowledgements to RQR, IDENT1 = REGI.

CAT - '000'.
TYPE - '01'.

FUNC - ACK, ACKI, ACKQ, ACKX, ACKV, ACKE, ACKT or ACKB.

IDENT2 - Ident of the calling radio unit.

QUAL - Qualifies the function (FUNC) of the acknowledgement. See below.

(N) - Aloha number. See random access protocol (section 7).

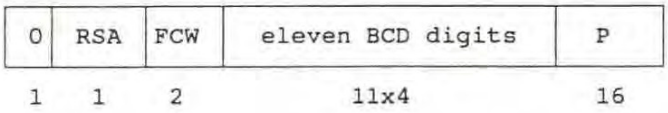
P - Parity check bits.

contd.

Data codewords following ACKT(QUAL=0) address codeword:

When ACKT(QUAL=0) is transmitted by the TSC, up to three data codewords may be appended to convey the diversion address or dialling information. The form of these data codewords depends on the value of IDENT1.

a. If IDENT1 = PSTNGI then up to three data codewords with the following structure may be appended to ACKT(QUAL=0):



RSA - Return Slot Access Flag.
When transmitted by the TSC on a control channel in the second half of a slot preceding an access slot:
'0' - radio units are not permitted random access in the following slot on the return control channel.
'1' - radio units are permitted random access in the following slot on the return control channel.
In all other cases of transmission, the meaning of the RSA flag is reserved, default='0'. See also 7.2.5.

FCW - Number of data codewords appended to this data codeword (in the same message):
'00' no data codewords follow
'01' one data codeword follows
'10' two data codewords follow
'11' reserved.

BCD - Eleven BCD groups representing the dialled digits of the diversion PSTN destination, coded in accordance with the table in Appendix 5. The BCD digits are transmitted in the dialled order (i.e. the leftmost digit in the above diagram is the earliest in the dialling order; digits in any following codeword are later in the dialling order).

P - Parity check bits.

contd.

b. If IDENT1 = PABXI then a single data codeword with the following structure is appended to ACKT(QUAL=0):

0	RSVD	SP	PARAMETERS	P
1	10	1	36	16

RSVD - Reserved for future definition. Default value = all '0's.

SP - '0' for a "long" PABX extension number.
'1' for an extension number that can be represented by 13 bits.

PARAMETERS - See parameter formats below.

P - Parity check bits.

Parameter formats

If SP='0'

BCD1	BCD2	BCD3	BCD4	BCD5	BCD6	BCD7	BCD8	BCD9
4	4	4	4	4	4	4	4	4

BCDn - BCD groups representing the dialled digits of the diversion PABX destination, coded in accordance with the table in Appendix 5. The BCD digits are transmitted in the dialled order.

If SP='1'

RSVD	EXCHANGE	Number
21	2	13

RSVD - Reserved for future definition.
Default value = all '0's.

EXCHANGE - Indicates the appropriate PABX exchange.

Number - PABX extension number.

contd.

c. If IDENT1 = IPFIXI then a single data codeword with the following structure is appended to ACKT(QUAL=0):

0	RSVD	GF	PFIXT	IDENTT	P
1	26	1	7	13	16

RSVD - Reserved for future definition. Default value = all '0's.

GF - '0' if the diversion address is an individual address.
'1' if the diversion address is a group address.

PFIXT - Prefix of the diversion address.

IDENTT - Ident of the diversion address.

P - Parity check bits.

contd.

Acknowledgements sent to calling radio unit to indicate progress of Simple or emergency call (as requested by an RQS or RQE message):

ACKI	(QUAL=0)	- Called unit alerting but user/ data equipment not ready.
ACKI	(QUAL=1)	- Intermediate acknowledgement; more signalling to follow.
ACKQ	(QUAL=0)	- All traffic channels in use. TSC has queued the call.
ACKQ	(QUAL=1)	- Conflicting call in progress (e.g. called unit engaged), or higher in queue. TSC has queued the call.
ACKX	(QUAL=0)	- Invalid call; request rejected.
ACKX	(QUAL=1)	- System overload; request rejected.
ACKV	(QUAL=0)	- Called unit not in radio contact or call set-up abandoned.
ACKV	(QUAL=1)	- Conflicting call in progress or higher in queue (and call has not been queued), or called user does not wish to receive this call.
ACKB	(QUAL=0)	- Called unit has accepted the call for call-back.
ACKT	(QUAL=0)	- Called party's calls have been diverted.

Acknowledgements sent to radio unit to indicate progress of Include call (as requested by an RQS on a traffic channel):

ACK	(QUAL=0)	- Include request accepted; called party will be directed to the traffic channel.
ACKI	(QUAL=0)	- Called party alerting but not yet ready.
ACKI	(QUAL=1)	- Intermediate acknowledgement; more signalling to follow.
ACKQ	(QUAL=0)	- All traffic channels in use on called site; more signalling to follow.
ACKX	(QUAL=0)	- Invalid call; request rejected.
ACKX	(QUAL=1)	- System overload; request rejected.
ACKV	(QUAL=0)	- Called unit not in radio contact or Include call abandoned.
ACKV	(QUAL=1)	- Conflicting call in progress (e.g. called party engaged), or called user does not wish to receive this call.
ACKT	(QUAL=0)	- Called party's calls have been diverted.

Acknowledgements sent during set-up of standard data communication (as requested by an RQD message):

To be defined.

Acknowledgements to cancel/abort message RQX:

ACK	(QUAL=1)	- Acknowledgement of RQX.

contd.

Acknowledgements to call diversion request RQT:

ACK	(QUAL=0)	- Call diversion or cancellation has been accepted.
ACKI	(QUAL=1)	- Intermediate acknowledgement; more signalling to follow.
ACKX	(QUAL=0)	- Invalid call; request rejected.
ACKX	(QUAL=1)	- System overload; request rejected.
ACKV	(QUAL=0)	- Transaction abandoned.

Acknowledgements sent as response to emergency call request RQE:

ACKE	(QUAL=0)	- Acknowledgement, wait for further signalling.

Acknowledgements to registration request RQR:

ACK	(QUAL=0)	- Registration accepted.
ACKI	(QUAL=1)	- Intermediate acknowledgement; more signalling to follow.
ACKX	(QUAL=0)	- Invalid request; registration denied.
ACKX	(QUAL=1)	- System overload; registration failed.

Acknowledgements sent to radio unit to indicate progress of status transaction (as requested by an RQQ message):

ACK	(QUAL=0)	- Transaction has been successfully completed, i.e. the called destination has accepted the status information.
ACKI	(QUAL=1)	- Intermediate acknowledgement; more signalling to follow.
ACKQ	(QUAL=0)	- System is busy. Wait for further signalling.
ACKQ	(QUAL=1)	- Called unit engaged. Wait for further signalling.
ACKX	(QUAL=0)	- Invalid call; message rejected.
ACKX	(QUAL=1)	- System or called unit overload; message rejected.
ACKV	(QUAL=0)	- Called unit not in radio contact or transaction abandoned.
ACKV	(QUAL=1)	- Called unit engaged (and TSC will not hold the request), or called unit does not wish to accept the information.
ACKT	(QUAL=0)	- Called unit's calls have been diverted.

Acknowledgements sent to radio unit to indicate progress of short data transaction (as requested by an RQC message):

ACK	(QUAL=0)	- Transaction has been successfully completed.
ACKI	(QUAL=1)	- Intermediate acknowledgement; more signalling to follow.
ACKQ	(QUAL=0)	- System is busy. Wait for further signalling.
ACKQ	(QUAL=1)	- Called party engaged. Wait for further signalling.
ACKX	(QUAL=0)	- Invalid call; message rejected.
ACKX	(QUAL=1)	- System or called unit overload; message rejected.
ACKV	(QUAL=0)	- Called unit not in radio contact or transaction abandoned.
ACKV	(QUAL=1)	- Called party engaged (and TSC will not hold the request) or called unit does not wish to accept the message.
ACKT	(QUAL=0)	- Called party's data calls have been diverted.

5.5.2.2 Acknowledgement messages sent by radio units

An acknowledgement may be sent by a radio unit in response to a TSC Ahoy or HEAD message that demands a reply. An acknowledgement is also sent if a radio unit receives an individually addressed Aloha message and has no suitable random access message to send (see 7.4.1 and 8.3.2.1).

1	PFIX	IDENT1	1	CAT 000	TYPE 01	FUNC	IDENT2	QUAL	(N)	P
1	7	13	1	3	2	3	13	1	4	16

PFIX - Prefix of the transmitting unit.

IDENT1 - IDENT1 from the TSC's message, unless the acknowledgement is sent in response to an individually addressed Aloha message, in which case IDENT1 is set to TSCI.

CAT - '000'.

TYPE - '01'.

FUNC - ACK, ACKI, ACKX, ACKV or ACKB.

IDENT2 - IDENT2 from the TSC's message, unless the acknowledgement is sent in response to an individually addressed Aloha message, in which case IDENT2 is the transmitting unit's ident.

QUAL - Qualifies the function (FUNC) of the acknowledgement.

(N) - Reserved for future definition. Default value = '0000'.

P - Parity check bits.

Acknowledgements to AHY (i.e. general availability check):

i) From called unit (PFIX/IDENT1 from AHY):

ACK (QUAL=0) - General acknowledgement; unit/ user/ data equipment ready for call.
ACKI (QUAL=0) - Unit alerting but user/ data equipment not ready.
ACKX (QUAL=0) - Call cannot be accepted (e.g. no data equipment, for a data call).
ACKV (QUAL=1) - User does not wish to receive this call (e.g. his "Busy control" is in the busy state).
ACKB (QUAL=0) - Call accepted for call-back.
ACKB (QUAL=1) - Data codeword appended to AHY was not decodeable and unit requires the message to be retransmitted.

ii) From requesting unit (PFIX/IDENT2 from AHY):

ACK (QUAL=0) - Unit is waiting for signalling for a call.
ACKX (QUAL=0) - Unit is not waiting for signalling for a call.

contd.

Acknowledgement from called unit to AHYX (cancel alert/waiting state):

ACK (QUAL=1) - Acknowledgement.

Acknowledgements from called unit to AHYQ (status message):

ACK (QUAL=0) - Unit has accepted the information in the AHYQ message.
ACKX (QUAL=0) - Unit is not equipped to accept the information.
ACKX (QUAL=1) - Unit cannot accept the information at this time (e.g. its queue is full).
ACKV (QUAL=1) - Unit does not wish to accept status information from this calling party.
ACKB (QUAL=1) - Data codeword appended to AHYQ was not decodeable and the unit requires the message to be retransmitted.

Acknowledgements to AHYC (instruction to send short data):

i) From called unit (PFIX/IDENT1 from AHYC):
ACKX (QUAL=0) - Unit is not equipped to send the required data.

ii) From calling unit (PFIX/IDENT2 from AHYC):
ACKX (QUAL=0) - Unit is not waiting to send address information or short data message.

Acknowledgements from called unit to HEAD message (short data):

ACK (QUAL=0) - Unit has accepted the information in the HEAD message.
ACKX (QUAL=0) - Unit is not equipped to accept the data message.
ACKX (QUAL=1) - Unit cannot accept the message at this time (e.g. its data store is full).
ACKV (QUAL=1) - Unit does not wish to accept a data message from this calling party.
ACKB (QUAL=1) - Not all the appended data codewords were decodeable and the unit requires the message to be retransmitted.

Acknowledgement to an individually addressed Aloha message (if addressed radio unit has no random access message to send):

ACKX (QUAL=0) - Acknowledgement, nothing to send.

Acknowledgement to an individually addressed AHYD message

1	PFIX	IDENT1	1	CAT 010	TYPE 01	FUNC	IDENT2	QUAL	RSVD	MODEM	P
1	7	13	1	3	2	3	13	1	3	1	16

RSVD - Reserved. Default value = all '0's

MODEM - as a response to AHYD, availability of modem for Standard Data any other response, reserved for future definition.

Default value '0'

'0' - 1200 bits/sec FFSK only available
'1' - Both customised rate and 1200 bits/sec available

5.5.3 Type '10' Messages (Requests and Ahoys)

The Request messages sent by radio units and the Ahoy messages sent by the TSC have the same Category and Type. For clarity, they are shown separately:

- Section 5.5.3.1 defines the Request codeword structures.
- Section 5.5.3.2 defines the Ahoy codeword structures.

5.5.3.1 Request Messages (Type '10')

These messages are transmitted to the TSC from a radio unit requesting a function. Request messages on a control channel are sent using the random access protocol (see 7.3).

The most usual basic structure is illustrated below but, for clarity of definition, the message for each function is detailed separately in sections 5.5.3.1.1 to 5.5.3.1.8.

1	PFIX	IDENT1	1	CAT 000	TYPE 10	FUNC	PARAMETERS	P
1	7	13	1	3	2	3	18	16

PFIX - Prefix of the requesting radio unit.

IDENT1 - Ident of the called party or gateway.

CAT - '000'.

TYPE - '10'.

FUNC - Specifies the function of the request:

'000'	RQS	Request Simple call
'001'		Spare. Available for customisation
'010'	RQX	Request call cancel / abort transaction
'011'	RQT	Request call diversion
'100'	RQE	Request emergency call
'101'	RQR	Request to register
'110'	RQQ	Request status transaction
'111'	RQC	Request to send short data message.

PARAMETERS - See following pages.

P - Parity check bits.

5.5.3.1.1 Request "Simple" Call Message, RQS

This message is transmitted to the TSC on a control channel by a radio unit requesting a non-emergency conversation or a channel over which any appropriate audio signalling, even a non-standard modulation or format, can be sent. See section 9 for the call procedures.

The RQS codeword contains all the information necessary to request a call to a unit or group of units with the same prefix, to all units in the system, to a prearranged PSTN destination or to a PABX extension that can be accommodated in the range 0-8191. In addition, RQS may be used to request entry into the extended addressing mode for an interprefix call, a general call to the PSTN or a call to a PABX extension with a "long" number; in this case, after receiving the RQS message, the TSC demands the full called party information using the AHYC message (see 5.5.3.2.8).

The RQS message may also be sent to the TSC by a radio unit on its allocated traffic channel, to ask for another party to join the call. See section 11 for the Include call procedures.

1	PFIX	IDENT1	1	CAT 000	TYPE 10	FUNC 000	IDENT2	DT	LEVEL	EXT	FLAG1	FLAG2	P
1	7	13	1	3	2	3	13	1	1	1	1	1	16

PFIX - Prefix of the requesting radio unit.

IDENT1 - Called party or gateway:
- Ident - for a common-prefix call
- IPFIXI - for an interprefix call
- ALLI - for a system-wide call
- number - for a short addressing call to a PABX extension (EXT='1')
- PABXI - for a call to a "long" PABX extension number
- PSTNSIj - for a call to a prearranged PSTN destination
- PSTNGI - for a call to a general PSTN destination.

CAT - '000'.
TYPE - '10'.
FUNC - '000'.

IDENT2 - Ident of the requesting radio unit.

DT - RQS message on a control channel:
'0' if the caller is requesting speech communication.
'1' if the caller wishes to send non-prescribed data.
RQS message on a traffic channel:
This bit shall be set equal to bit D from the GTC message that allocated the traffic channel.

contd.

LEVEL - RQS message on a control channel:
This bit specifies 2 levels of priority
(both non-emergency).
High priority is '0', non-priority call is '1'.
RQS message on a traffic channel:
This bit shall be set to '1'.

EXT - '0' if IDENT1 is not a short addressing PABX extension number.
'1' if IDENT1 is a short addressing PABX extension number.

FLAG1 - For a group call (common-prefix or interprefix):
'0' - enable called users to reply
'1' - disable called users from replying.
For a short addressing call to a PABX extension,
FLAG1/FLAG2 indicates the appropriate PABX exchange.
For a general call to the PSTN:
'0' - number has up to 9 dialling digits
'1' - number has 10 to 31 dialling digits.
For all other types of call, FLAG1 is reserved for future
definition. Default value='0'.

FLAG2 - For a short addressing call to a PABX extension,
FLAG1/FLAG2 indicates the appropriate PABX exchange.
For all other types of call, FLAG2 is reserved for future
definition. Default value='0'.

P - Parity check bits.

5.5.3.1.2 Request Codeword Free for Customisation,Not defined

This message may be transmitted to the TSC on a control channel by a radio unit which is requesting a customised service.

5.5.3.1.3 Call Cancel / Abort Transaction Request Message, RQX

This message is transmitted to the TSC on a control channel by a radio unit in order to:

a. cancel a previous call request, while waiting for its requested call to be set up, or

b. abort a transaction e.g. a status transaction.

It may also be transmitted to the TSC on a traffic channel by a radio unit, in order to cancel an Include call request, while waiting for signalling for its Include call.

1	PFIX	IDENT1	1	CAT 000	TYPE 10	FUNC 010	IDENT2	RSVD	P
1	7	13	1	3	2	3	13	5	16

PFIX - Prefix of the requesting radio unit.

IDENT1 - Called party or gateway:
- Ident - for a common-prefix call
- IPFIXI - for an interprefix call
- ALLI - for a system-wide call
- PABXI - for a call to a PABX extension
- PSTNSIj - for a call to a prearranged PSTN destination
- PSTNGI - for a call to a general PSTN destination
- TSCI - for an RQQ or RQC transaction with the TSC
- DIVERTI - for aborting a general cancellation by a recipient of diversions.

Note: IDENT1 is the same as IDENT1 from the request being cancelled/aborted, except for a short addressing PABX call.

CAT - '000'.

TYPE - '10'.

FUNC - '010'.

IDENT2 - Ident of the requesting radio unit.

RSVD - Reserved for future definition. Default value = '00000'.

P - Parity check bits.

5.5.3.1.4 Request Call Diversion Message, RQT

This message is transmitted to the TSC on a control channel by a radio unit to request either that future calls addressed:

- to itself, or
- to another subscriber unit or group

be redirected to a specified alternative destination; the destination may be a radio or line unit, a group, a PABX extension or a PSTN number.

This message is also used by a radio unit to request:

- cancellation of the diversion of its calls, or
- cancellation of the diversion of another party's calls, or
- cancellation of any existing diversions to it.

See section 12 for the diversion procedures.

1	PFIX	IDENT1	1	CAT 000	TYPE 10	FUNC 011	IDENT2	SD	DIV	FLAG1	FLAG2	P
1	7	13	1	3	2	3	13	2	1	1	1	16

PFIX - Prefix of the requesting radio unit.

IDENT1 - For diversion requests:
party or gateway to which calls are to be redirected: ident, IPFIXI, PSTNSIj, PSTNGI or PABXI (for any PABX extension).
For "self" or "third-party" cancellation:
ident of the unit or group whose calls should be returned (or IPFIXI for an interprefix address).
For general cancellation by a recipient of diversions:
set to DIVERTI.

CAT - '000'.

TYPE - '10'.

FUNC - '011'.

IDENT2 - Ident of the requesting radio unit.

SD - Specifies the types of calls to which the request to divert or cancel divert applies:
'00' if both speech and data calls are to be redirected.
'01' if only speech calls are to be redirected.
'10' if only data calls are to be redirected.
'11' reserved for future use.
For diversion purposes, "speech" calls are defined as calls requested using RQS(DT=0), RQE(D=0), RQQ(STATUS='00000') or RQQ(STATUS='11111'). "Data" calls are defined as calls requested using RQS(DT=1), RQE(D=1), RQQ('00001'-'11110'), RQC or RQD.

contd.