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RADIOCOMMUNICATIONS
AGENCY

MPT 1347

Radio interface specification

For commercial trunked networks operating in Band III, sub-bands 1 and 2

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FOREWORD

This specification contains the radio interface requirements to be met by trunking system controllers and the associated base stations to be used in commercial trunked networks operating in Band III, sub-bands 1 and 2.

A companion specification, MPT 1343, contains the requirement to be met by radio units to be used with these networks.

These complementary specifications are intended to enable a user to migrate from one commercial trunked network to another without having to change mobile radio unit.

Intellectual Property Rights

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

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

CONTENTS

1 SCOPE

This specification is designed to be read in conjunction with MPT specifications 1323, 1327 and 1343, and contains the radio interface requirements to be met by trunked system controllers and associated base stations to be used in commercial trunked networks operating in Band III sub-bands 1 and 2.

It covers the requirements for the following:

- Signalling, based on MPT 1327;
- Radio frequency parameters, where they are different from MPT 1323;
- Technical interfaces for operation with radio units meeting MPT 1343;
- Network operation;

There are two main types of requirement:

- Mandatory, applicable to all networks;
- Optional, but implemented in a standard manner in networks where the options are implemented.

2 ASSOCIATED DOCUMENTS

MPT 1317 (1981)	Code of practice for the transmission of digital information over land mobile radio systems.
MPT 1318 (1986)	Engineering memorandum: Trunked systems in the land mobile service.
MPT 1323 (1987)	Angle modulated radio equipment for use at base and mobile stations in the private mobile radio service operating in the frequency bad 174-225 MHz.
MPT 1327 (1987)	A signalling standard for trunked private land mobile radio systems.
MPT 1331 (1987)	Code of practice for radio site engineering.
MPT 1343 (1988)	System interface specification for radio units to be used with commercial trunked networks operating in Band III sub-bands 1 and 2.
MPT 1352 (1991)	Test schedule for the approval of radio units to be used with commercial trunked networks operating in Band III sub-bands 1 and 2.

3 GENERAL

3.1 Definitions

The definitions of terms used in this specification are given in MPT 1343. Two further definitions are given here:

Network operator: The licensed operator of the network(s).

System standard data: This refers only to data messages originated or regenerated by the system using the data modulation specified in section 4.2.3 and with the form specified in MPT 1327, section 3. This definition excludes standard data signals originated by a unit but passing through the system without the system taking any responsibility for their form.

Section numbers appearing between !! !! delimiters in this specification refer to section numbers within MPT 1327. Section numbers appearing between %% %% delimiters refer to section numbers within MPT 1343.

3.2 Environmental Requirements

Unless otherwise specified, base stations shall meet the requirements of this specification under extreme test conditions, as defined in MPT 1323, section 2.4. Other equipment shall be designed so as to take into account the environment in which it shall operate. Specified limits or requirements shall not be exceeded due to environmental conditions.

4 TRANSMITTER PARAMETERS

4.1 Frequency Parameters

4.1.1 Channel Spacing and Designation for Sub-band 1

The channel spacing shall be 12.5 kHz. the channel designations shall be as follows:

Channel Number	CHAN field binary representation of channel number	Base station transmitter frequency
1		176.5000 MHz
58	1000000001	177.2125 MHz
560	1111110111	183.4875 MHz

The equipment shall be capable of operating on at least any one selected channel within the range 58 to 560 (177.2125 MHz to 183.4865 MHz). Transmission outside this frequency range is not permitted.

4.1.2 Channel Spacing and Designation for Sub-band 2

The channel spacing shall be 12.5 kHz. The channel designations shall be as follows:

Channel Number	CHAN field binary representation of channel number	Base station transmitter frequency
1		200.5000 MHz
58	0000000001	201.2125 MHz
560	0111110111	207.4875 MHz

The equipment shall be capable of operating on at least any one selected channel within the range 58 to 560 (201.2125 MHz - 207.4875 MHz). Transmission outside this frequency range is not permitted.

4.1.3 Frequency Tolerance

The carrier frequency transmitted shall be within 1.0 kHz of the nominal transmit frequency.

4.2 Modulation Characteristics

4.2.1 General

The peak frequency deviation shall not exceed ±2.5 kHz.

4.2.2 Speech Modulation

Speech transmissions shall employ a phase modulation characteristic.

4.2.3 System Standard Data Modulation

System standard data modulation shall be by audio subcarrier modulation employing phase continuous fast frequency shift keying (FFSK) to a frequency modulation characteristic at the RF carrier. During transmission of system standard data all audio other than this data signal shall be muted by at least 35 dB. The parameters of the modulation shall be as follows:

Bit rate	1200 Bit/s
Modulation rate	1200 Baud
Binary '0'	1800 Hz
Binary '1'	1200 Hz
Amplitude difference	< 1.5 dB
Data element boundaries	Phase 0° or 180°
Peak deviation	
Normal conditions	1.5 kHz ± 250 Hz
Extreme conditions	1.5 kHz ± 500 Hz

The method for modulating any other data is not prescribed in this specification.

4.3 Performance Parameters

Transmitters shall meet the requirements of MPT 1323.

Intermodulation attenuation shall be at least 40 dB for any intermodulation component. This may be achieved by the use of isolating devices external to the transmitter.

5 RECEIVER PARAMETERS

The requirements of this section shall be met under normal test conditions, as defined in MPT 1323 section 2.3, unless otherwise specified.

5.1 Frequency Parameters

5.1.2 Channel Spacing and Designation for Sub-band 1

The channel spacing shall be 12.5 kHz. The channel designations shall be as follows:

Channel Number	CHAN field binary representation of channel number	Base station receiver frequency
1		184.5000 MHz
58	1000000001	185.2125 MHz
560	1111110111	191.4875 MHz

The equipment shall be capable of operating on at least any one selected channel within the range 185.2125 MHz to 191.4875 MHz. Opeation outside this range is not permitted.

5.1.2 Channel Spacing and Designation for Sub-band 2

The channel spacing shall be 12.5 kHz. the channel designations shall be as follows:

Channel Number	CHAN field binary representation of channel number	Base station receiver frequency
1		192.5000 MHz
58	0000000001	193.2125 MHz
560	0111110111	199.4875 MHz

The equipment shall be capable of operating on at least any one selected channel within the range 193.2125 MHz - 199.4875 MHz. Operation outside this frequency range is not permitted.

5.1.3 Frequency Tolerance

The centre frequency of the response of the receiver shall be within 1.0 kHz of the nominal receive frequency.

5.2 Demodulation Characteristics

5.2.1 Speech Signals

The speech demodulator shall have a phase demodulation response characteristic. The permitted departure from the phase demodulation response amplitude characteristic over the audio frequency range 300 Hz to 2.55 kHz shall be ±3 dB, ie the total audio output power shall fit totally within the mask of figure 5.1.

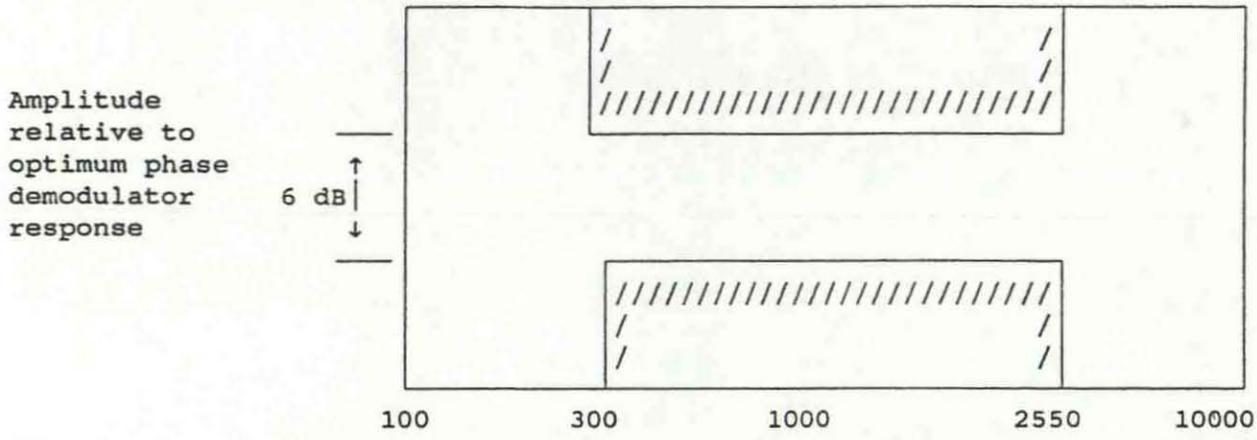


Figure 5.1

5.2.2 Data Signals

Received standard data signals have a fast frequency shift keying (FFSK) characteristic. Standard data modulation follows the requirements of MPT 1323, that is phase continuous 1200 baud FFSK, with 1800 Hz representing binary '0' and 1200 Hz representing binary '1'.

Note: The received peak deviation of standard data does not exceed ±2.0 kHz and is not less than ±1.0 kHz. For non-prescribed data, the peak frequency deviation does not exceed ±2.5 kHz.

5.3 Performance Parameters

Base station receivers shall meet the requirements of MPT 1323.

6 NETWORK PARAMETERS

6.1 Introduction

This section details both the fixed and variable parameters which allow a radio unit to be customised and personalised to take service from a network.

The data is divided into two categories: network dependent data (which defines how the radio unit operates), and user address data (which contains address and call information).

6.2 Network Dependent Data

The network operator shall provide the following information to allow radio units to be customised for the particular network.

	Parameter	Item Size/Range of values	Number of Entries
1	Zone sub-field length	0 to 9 bits	1
2	Area sub-field length	0 to 9 bits	1
3	Identity code of selected network	2 or 7 bits	1
4	Normal Hunt Channel Numbers/	10 bits + TS flag	32
	Size of Hunt	Range 1 to 32	1
5	Lowest Channel No in Network	10 bits	1
6	Highest Channel No in Network	10 bits	1
7	Suppress Comprehensive Hunt	Flag	1
8	Value of INFO to be used in RQR	15 bits	1
9	LM1 Level margin (see 9.3.5)	0 to 40 dB in steps of 6 dB	1
10	LM2 Level margin (see 9.3.5)	0 to 40 dB in steps of 6 dB	1
11	LM3 Level margin (see 9.3.5)	0 to 40 dB in steps of 6 dB	1
12	NC1- Size of Error Check Sample prior to confirmation	0 to 255 step 1	2
13	NC2- Size of Error Check Sample after confirmation	0 to 255 step 1	2
14	NDD preference data	Max. 9 bits	4 min.
15	NS- No. of samples in background sampling activity	1 to 10 in steps of 1	1
16	NV- No. of consecutive CCSCs during verification	1 to 16 step 1	2
17	NX1- Error codeword limit prior to confirmation	0 to 255 step 1	2
18	NX2- Error codeword limit after confirmation	0 to 255 step 1	2
19	NZ1- No of samples for error checking prior to confirmation	1 to 255 step 1	1
20	NZ2- No of samples for error checking after confirmation	1 to 255 step 1	1
21	NPON Number of Pressel On Messages	1 to 5	1

22	NPOFF Number of Pressel Off Messages	1 to 5	1
23	PREFERRED NDD priority indicator	1 to 10 in steps of 1	4 min.
24	PREFERRED NDD sub-field length	Range 0 to 9 bits	4 min.
25	TC- Random Access Timeout	0 to 120 secs step 10	1
26	TD- Registration Record Timeout	0 to 70 min step 5	1
27	TGI- Short Data Message Individual time out observed when radio unit responds to HEAD with ACK (QUAL = 0) or ACKB (QUAL = 1)	1 to 15 seconds in 1 second steps	1
28	TGG- Short Data Message Group timeout observed when radio unit receives a group HEAD message	1 to 30 seconds in 1 second steps	1
29	TH- Sampling activity duration	0 to 100 slots in steps of 1,	1
30	TL- Sampling activity interval	0 to 3000 slots in steps of 100, or 0 to 310 seconds in steps of 10	1
31	TJ- Further Signalling Timeout	0 to 60 secs step 10	1
32	TN- Traffic Channel Timeout	0 to 10 secs step 1	1
33	TS- Delay before leaving a Control Channel	0 to 10 secs step 1	1
34	TT- Maximum Item Duration	0 to 60 secs step 10	1
35	Home Zone	0 to 9 bits	1
36	Non-applicable Channel Nos	10 bits	Unspecified
37	NT- Max TSC Response Delay to Unsolicited Traffic Channel Message	103 to 1236 bits step 103 bits	1
38	TU- Data Call Duration Timer	30 to 180 secs Step 30 secs	1
39	Suppress Data Call Duration Timer	Flag	1
40	TA- Timeout for called radio unit after receiving AHY	10 to 120 second steps OR fixed at 60 seconds	1
41	TW- Timeout for radio unit waiting for call	60 seconds	1

6.3 User Address Data

6.3.1 Data Programmed Into all Radio Units

The following data has to be programmed into all radio units. The source of this data is not specified.

	Parameter	Item Size/Range of values	Number of Entries
1	Own Prefix	7 bits	1
2	Own Individual Indent	13 bits	1
3	Access Authorisation Data	Max 9 bits	8 min
4	Radio Unit Control Category	1 of 4	1

6.3.2 Data Programmed Into Some Radio Units

The following data may require to be programmed into certain radio units, dependent upon the facilities offered by the radio unit manufacturer. The source of this data is not specified.

	Parameter	Item Size/Range of values	Number of Entries
1	Own Group Address	20 bits	4 min
2	Individual Base Ident	13 bits	1
3	Group Base Ident	13 bits	1
4	Two or Three Digit Individual Calls	Flag	1
5	Two or Three Digit Group Calls	Flag	1
6	Highest Permitted Own Fleet Individual Ident	13 bits	1
7	Highest Permitted Own Fleet Group Ident	13 bits	1
8	Single Digit Number Destination	Unspecified	10 max
9	Look-up Table for 5-digit Inter-fleet Calls	Unspecified	Unspecified
10	*0% and *0nn# Immediate Address	13 bits	1/2
11	*9# Immediate Address	13 bits	1/2
12	*2 Immediate Access	13 bits	1
13	Inter Fleet Group Calls Barred	Flag	1
14	Channel No for Fall-back	10 bits	1
15	Value of NDD in SYS code for Fall-back Service	4/9 bits	1
16	SIL System Indicator Locator sub-field length	Range 3 to 9 bits in steps of 1	1
17	** Abbreviated Dialling Maximum Limit	8 bits	1
18	Disable FOACSU	Flag	1
19	CLIM- Network personalisation data; maximum call duration for a non-emergency call	10 secs to 4 mins 14 secs in 1 sec steps, or 5 mins to 13 mins in 1 min steps, or inhibited	1
20	CLIME- network personalisation data; maximum call duration for an emergency call	10 secs to 4 mins 14 secs in 1 sec steps, or 5 mins to 13 mins in 1 min steps, or inhibited	1

6.4 Fixed Parameters

The following radio unit parameters are fixed and networks must take these into account.

			Value
1	ND1	- No of disconnect messages sent by called radio unit	3
2	ND2	- No of disconnect messages sent by calling radio unit	5
3	NE	- Max no of random access transmissions of RQE	16
4	NI	- Max no of include request access attempts	4
5	NR	- Max no of random access transmissions of RQS, RQD, RQX, RQT, RQR or RQQ	8
6	NW	- Response delay (in frames)	5
7	TB	- Time barred from calling same ident after ACK/ACKX/ACKV or any ident after ACKT/ACKB	2 s
8	TF	- Value of TS in fall-back mode	180 s
9	TI	- Include timer	2 s
10	TP	- Max interval between periodic messages to be assumed at switch-on or equivalent	5 s
11	TX	- Value of TC in fall-back mode	180 s
12	TR	- Call set-up - Data Keyline delay	500 ms

6.5 Network Customisation

The previous sections have detailed the requirements and limits for the variables specified in MPT 1343. A network operator is free to design his network with particular functions (eg time shared control channels, fall-back, full-off-air-call-set-up etc) provided that the above requirements are complied with.

7 SECURITY

Each radio unit stores a unique 38 bit security number which is programmed by the radio unit manufacturer and which can be accessed by the system. Various restrictions are imposed on radio unit manufacturers towards safeguarding the integrity of this number (see MPT 1343 section 7).

There is no requirement on the system to read or check the security number of a mobile, but performing the check on security number will reduce or discourage abuse and fraud in the following areas:

1 Theft of radio units;
2 Cloning of radio units;
3 Use of unapproved equipment;
4 Fraud by modification of identity;
5 Denial of responsibility to pay a bill for use of the system.

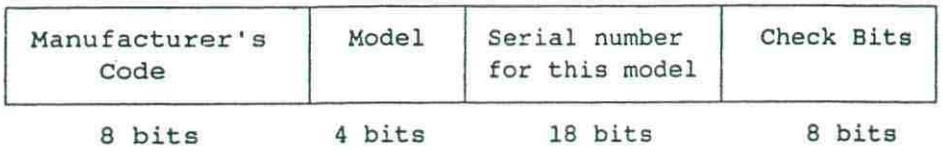
There are a number of steps that may be taken by a system once a security number has been read from a radio unit:

1 Check the security number against a whitelist of numbers permitted to use the system, checking that the individual user identity matches that expected. (In practice, the security number would be stored in a location determined by the individual user identity, along with billing information if applicable.)

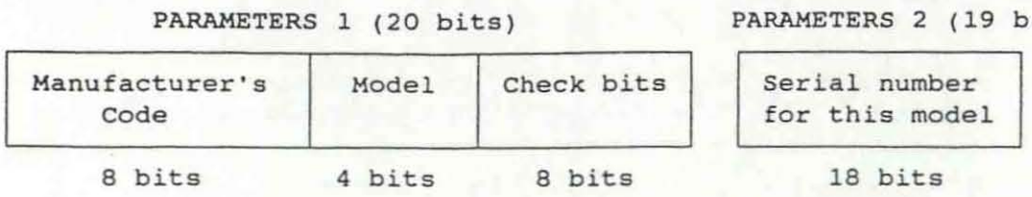
2 Check the security number against a blacklist of known "rogue" radio units (alone, this is less useful than (1) above). A blacklist may be useful to help locate stolen mobiles.

3 The system may check the integrity of the 8 check bits (see below) within the security number. This does not need storage of lists, and may be useful initially and on systems with limited processing or storage capability.

The format of the security number is as follows:



The system may request a radio unit to transmit its security number using an AHYC message (see MPT 1327 Sections 5.5.3.2.8, 9.1.1 and 15). The radio unit responds with the security number in a SAMIS message (see MPT 1327 Section 5.6.1.2.2). The parameter fields of the SAMIS message are constructed as follows:



Manufacturer's code: An 8 bit number (0 to 255), one or more of which is issued to each radio unit manufacturer by the licensing body (ie the Radiocommunications Agency in the UK).

Model: A 4 bit number (0 to 15) which is unique to a radio unit type for a given manufacturer's code. The model number is allocated by the manufacturer as and when new radio unit models are to be type approved. In the event of a radio unit manufacturer producing more than 16 type approved models, the manufacturer may apply for an additional manufacturer's code.

Serial number (for this model): The serial number of the radio unit of a given model. This model number is allocated by the manufacturer, and would normally run from 1 up towards 262143. Where this capacity is exceeded, the radio unit manufacturer may allocate an additional model number to radio units of the same type approval type.

Check bits: The algorithm for calculating the check bits is based on the data contained in the other fields above. The algorithm used in the UK is available from the DTI to manufacturers and network operators. If the check bits are incorrect in a radio unit, a network may refuse access to that radio unit. The algorithm will not be present in the radio unit.

Manufacturer's codes and the security algorithm can be obtained by writing to the following address:

Mobile Technology Section
Radiocommunications Agency
Room 514
Waterloo Bridge House
London SE1 8UA

8 NUMBERING CONVENTION

8.1 Introduction

The primary objective of the numbering convention is to provide a means of dialling short number strings on radio units for in-fleet calls by reference to common base identities and group identities to fleets therefore each need blocks of contiguous identities. The lowest identity in each block (the base ident) has an even value. the blocks of individual and group identities for one fleet both operate within a common prefix. Networks shall conform to this convention.

Radio units numbers which are dialled by the radio unit user are translated, in the radio unit, into unit addresses by means of algorithms which use the dialled number and the base ident or the latter's allegory, the fleet number (%%8.2.3.1%%).

The network may restrict the calls that the unit is permitted to make to identities within the fleet allocation or, in addition, to other parts of the addressing range. Conversely no restrictions need to be made to any unit which is allowed full access to all other units on the network or to units which have internal limitations on the number of identities which the unit can call. The network may also be connected to other communications networks and facilities such as:

- PABX networks
- PSTN networks
- Operator services

The network may restrict traffic between radio units and these networks to meet user requirements in a similar manner to restrictions applied to inter-unit calls.

The options described in this specification are not an exhaustive list. Other options may be incorporated into the system design as may be required by the network operator.

8.2 Network Options

This network may maintain records of each fleet starting address and finishing address for both individual and group address blocks. This information may be made available to service providers for inclusion in the network personalisation data installed in each radio unit.

8.2.1 Call types:

i. Inter-unit calls

A unit address or a group address consists of a combination of any prefix (PFIX) with an identity (IDENT) in the range 1 to 8100. The use of other aduresses is specified in MPT 1327, Section 4 and in sub-sections iv and v below.

The network may restrict the acceptance of call set-up requests from any unit to pre-arranged parts of the addressing range.

ii. Outgoing PABX calls

Random access requests (RQn) with EXT = '1' may be accepted from radio units for calls to a PABX. Such call requests will contain an offset telephone extension number in IDENT1 with additional routing in FLAG1 and FLAG2 (!!5.5.3.1.1!!).

For received IDENT1 = 0 to 7999 the network shall recover the original dialled number by adding 1000 (base 10) to the received IDENT1, and shall offer the recovered number to the selected PABX (%%8.2.5%%). Leading digits in the dialled string may be discarded by the network if the connected PABX has less than four digits in its numbering scheme.

The candidate PABX (one of four maximum) shall be selected by reference to the calling party identity and the setting of FLAG1 and FLAG2. PABXs are selected according to the table:

Candidate PABX	FLAG1	FLAG2
1	0	0
2	0	1
3	1	0
4	1	1

If the radio unit sends IDENT1 = 8000 the network may select the PABX defined by FLAG1 and FLAG2, as defined above, and set up a call to the PABX Operator (%%8.2.5.1, 8.2.5.2%%). Values of IDENT1 = 8001 to 8191 are available for customisation.

The network may also accept random access requests (RQn) to PABXI (IDENT 8102) with EXT = '0' from radio units for extended addressing calls to larger PABX networks. Such calls send all dialling information (including exchange routing digits) in a SAMIS on demand from the network (%%8.2.5.6%%). Connection shall be to the PABX network specified by the unit user.

iii. Outgoing PSTN calls

The network may accept random access requests (RQn except RQQ) from radio units for extended addressing calls via IDENT 8101 (PSTNGI). Such calls send full national or international numbers (less the leading zero) in a SAMIS plus optional data codewords on demand from the network. (%%8.2.6.2%%).

The network may also accept random access requests (RQn) from radio units for short addressing calls via IDENTs 8121 to 8135 (PSTNSIj). Each IDENT for such calls is translated into a full national or international number by the network using data held by the network for each radio unit or fleet. Connection may be to any UK PSTN by arrangement with the relevant PSTN operator. (%%8.2.8.1%%).

The digit string sent to the PSTN for each call and the method of connection will be agreed with the chosen PSTN operator who may require the restoration of the leading zero of the dialled string.

iv. Special IDENTs 8136 to 8169

Special IDENTs 8136 to 8169 are spare for customisation.

v. Operator Services

The network may offer operator services to callers on receipt of special IDENTs 8170 to 8180. It is recommended that 8170 is used for calls to a call assistance operator and 8180 to an emergency operator. With the exception of 8170, which is originated in the radio unit by the dialled string 100, and 8180, which is originated by the dialled string 999, the IDENTs 817x correspond to dialled strings 1x1 and the service which is offered is at the discretion of the network operator. eg:

Radio Unit Dialled String	Special Ident
100	8170
111	8171
121	8172
131	8173
141	8174
151	8175
161	8176
171	8177
181	8178
191	8179
999	8180

8.3 Call Diversion

Numerical or addressing information which is received from the divertor as part of a diversion request for the divertor (RQT, DIV = '0', FLAG 2 = '0'), ie the contents of IDENT1, or the accompanying numerical or addressing data received in response to an AHYC sent by the system if IDENT1 = IPFIXI, PABXI, or PSTNGI, may be stored against the divertor's address and sent as a response to any call request to that address. If the diversion address is a PSTN number or PSTNSIj and the caller has the number, or equivalent number, in store as a short form address, the appropriate PSTNSIj may be sent to the caller, otherwise the full PSTN number may be sent to the caller as the diverted call destination.

8.3.1 Third party diversions

Numerical or addressing information which is received from the divertor as part of a diversion request on behalf of a third party (RQT, DIV = '0', FLAG 2 = '1'), ie the contents of IDENT1, or the accompanying numerical or addressing data received in response to an AHYC sent by the system if IDENT1 = IPFIXI, PABXI, or PSTNGIj, may be stored against the address of the unit which is indicated by the calling unit upon the system sending an AHYC, IDENT1 = DIVERTI, and sent as a response to any call request to that address. If the diversion address is a PSTN number or PSTNSI and the caller has the number, or equivalent number, in store as a short form address, the appropriate PSTNSIj may be sent to the caller, otherwise the full PSTN number may be sent to the caller as the diverted call

destination.

Call diversion requests from either self-interested parties or third parties may displace earlier requests set up by either method.

8.3.2 Cancel Diversion

A cancel diversion request (RQT, DIV = '1', FLAG 2 = '0') cancels the diversion state for the unit whose address is PFIX/IDENT1, or the address data received in response to an AHYC sent by the system if IDENT1 = IPFIXI.

8.4 Storage Requirements

The network may store the following data for each radio unit or fleet:

1 Fleet base identity for individual calls (%%8.2.3.1%% IBI);

2 Fleet base identity for group calls (%%8.2.3.1%% GBI);

3 Highest used identity for individual calls (or block size);

4 Highest used identity for group calls (or block size);

5 Up to 15 PSTN numbers for translation from PSTNSIj (8121 to 8135) (%%8.2.8.1.1%%);

6 Up to 34 network defined numbers or facilities for translation from spare IDENTs 8136 to 8169 (%%8.2.8.1.1%%);

7 Up to 11 sets of routing data for network operator services for translation from spare IDENTs 8170 to 8180 (%%8.2.7%%);

8 The following storage requirements are requested for each call diversion interception:

a. Diverted party address;

b. Diversion destination;

c. Divert Speech/Divert Data flags.

9 CONTROL CHANNEL OPERATION

9.1 Control Channel Availability

The control channel is the medium which allows the population of radio units to communicate with the network control elements (the TSC of MPT 1327), when they are not assigned to traffic channels. Therefore, it is recommended that networks are designed to ensure as far as practicable that at least one control channel is available substantially continuously at all points within the planned network coverage area. The format of the data signalling on this channel shall conform to !!3.3.3!!.

The term "substantially continuously" takes account of factors which may result in short breaks in the continuity of control channel availability.

Examples of these factors are:

- the vagaries of propagation;
- equipment failure;
- configuration changes;
- permitted control channel operational modes which require control channel cycling, either amongst channels at the same site or by time-sharing on the same channel between sites. In systems which cycle channels at the same site it is also permitted temporarily to suspend control channel service when all channels are in traffic.

It should be noted that the control channel shall be able to be operated in a manner which will yield efficient use of all the allocated channels, particularly during periods of high traffic loading.

The control channel acquisition procedures for radio units specified in MPT 1343 have been devised as far as practicable to cater for the full range of possible operating modes. It should be noted that some non-dedicated control channel strategies may be inefficient in a multi-site situation where the radio unit is required to hunt through more than a small number of channels, but that this technique may be appropriate for small networks using only a few channels.

9.2 Control Channel Frequencies

In order to facilitate the radio unit control channel acquisition procedures it is recommended that network operators, wherever possible, restrict the frequencies used for control channels within their networks to a predesignated set of up to 32 frequency pairs. The control channel acquisition procedures do allow, however, for radio units to hunt for and acquire control channels which use frequencies not within the predesignated set, but acquisition of such channels may be a longer process. The network operator shall make available a list of up to 32 channel numbers nominated as control channel frequency pairs for radio unit

personalisation purposes (the normal hunt channel numbers).

In order to facilitate the hunt for control channels outside the normal hunt channel numbers, the network operator shall also make available for radio unit personalisation purposes the lowest and highest channel number used for control or traffic channel purposes within the network. In addition, he may provide a list of channel numbers for frequency pairs which are not used for any purpose by the network.

The facility to hunt for control channels outside the normal hunt channel numbers may be suppressed in the radio unit by network personalisation.

9.3 Forward Control Channel Structure

9.3.1 General Format

Every forward control channel radiated by the network shall conform to !!3.3.3.1!! of MPT 1327. The first codeword of every slot shall be a Control Channel System Codeword (CCSC), unless displaced by a data codeword in accordance with the provisions of !!3.3.3.2!! of MPT 1327.

The CCSC shall carry information in the System Identity Code (SYS) field to identify the transmitting system (see 9.3.2). Serial transmissions on the same control channel frequency pair may bear CCSCs with different SYS field values, but it is recommended that, generally, each transmitting location should be assigned one or more unique values of SYS code for site identification purposes.

9.3.2 Structure of the System Identity Code

9.3.2.1 General Forms

The structure of the System Identity Code shall conform to one of the two general forms below. The form to be used by each network will be advised by the RA (address as on page 7.2).

With bit 1 of the SYS field set to '0':

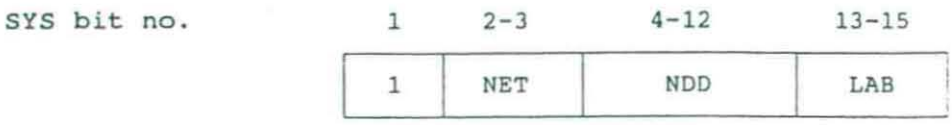
SYS bit no.	1	2-8	9-12	13-15
	0	OPID	NDD	LAB

OPID - Network operator identity - to be allocated by RA.

NDD - Network dependent data (see 9.3.2.2).

LAB - Label for multiple control channels (see 9.3.2.3).

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



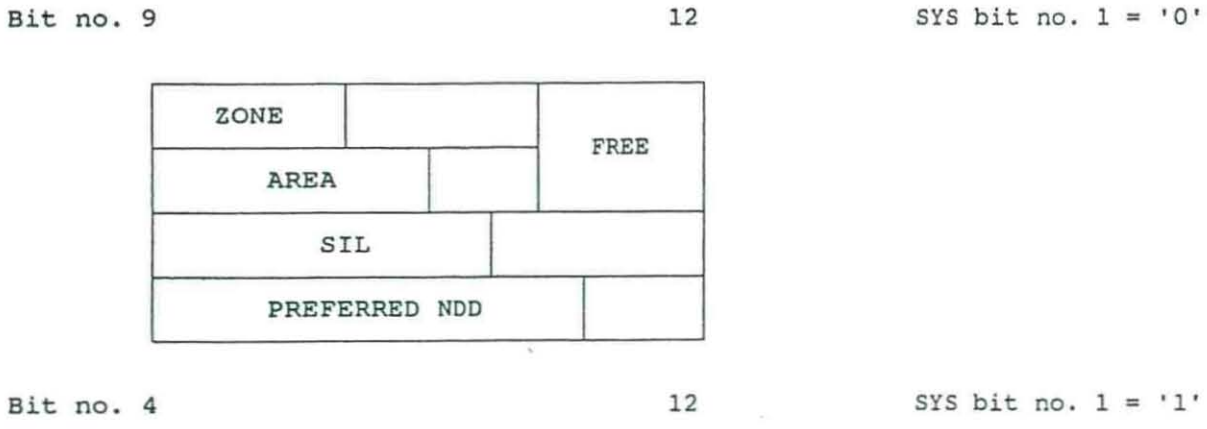
NET - Network operator identity
'00' National network no. 1
'01' National network no. 2
'10' Reserved
'11' Reserved

NDD - Network dependent data (see 9.3.2.2).

LAB - Label for multiple control channels (see 9.3.2.3).

9.3.2.2 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:



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 in MPT 1343).

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-set 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 procedures.

In order to allow radio units to interpret the network dependent data sub-field the network operator shall make available the following information for radio unit personalisation purposes.

- the length of the ZONE sub-field (LZ)
- the length of the AREA sub-field (LA)
- lengths of the PREFERRED NDD sub-fields for optional radio unit background search facility.

The network operator shall utilise only one value of LZ and LA for all SYS codes radiated by the network but may define the lengths of any number of PREFERRED NDDs bearing in mind that radio units which implement the option are obliged to store a minimum of four values of PREFERRED NDD. Additionally the values for LZ and LA apply globally to all radio units that use the network but values of PREFERRED NDDs are unit specific.

9.3.2.3 Multiple Control Channels

The network operator may wish to radiate more than one control channel at a particular site location and to sub-divide the radio unit population to allow load sharing between these control channels. This facility is provided by the LAB sub-field in the system identity code (see 9.3.2.1) and by control categorisation of radio unit.

The network operator shall provide a control category for each radio unit authorised to use the network. This control category shall be assigned as part of the network personalisation data for each radio unit. Four categories are available, which are designed A, B, C and D for convenience. The method by which control categories are assigned is at the discretion of the network operator.

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

'000' Reserved (future definition in MPT 1347)
'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

A change in the LAB field value on a control channel which currently has a population of radio units will result in radio units previously permitted and now denied entering the control channel acquisition procedures. The redistribution of radio units, in this instance, may be facilitated by the use of the MOVE message to redirect radio units to a particular control channel (see !!7.4.2!! of MPT 1327).

9.3.3 Acquisition Authorisation Data

Without specific personalisation data to the contrary a radio unit will attempt to access and, if applicable, register on any control channel which bears the network operator identity (OPID or NET), as applicable to the selected network. Acquisition authorisation data is a class of network personalisation data which allows the network operator to restrict this general acquisition authorisation to particular sectors of the network.

The radio unit provides for at least eight entries of acquisition authorisation data. Any one entry may be in any of three classes and any combination of classes in the eight, or more, entries may be accommodated. The three classes of acquisition authorisation data are:

- 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').

The aggregate acquisition authorisation for a particular radio unit is the union of all cases covered by the totality of acquisition authorisation data held by that unit.

9.3.4 Optional NDD Preference Data

The radio unit has the option to hunt for SYS codes containing NDD data which is preferred for operational reasons. The unit ranks this Preferred NDD data in order of preference to enable it to leave a preferred control channel for another preferred control channel with a higher priority.

The network operator shall define:

- The bit patterns (maximum length 9 bits) for each value of NDD preference data required in the radio unit Type A memory.

- The sub-field length (range 0 - 9) for each value of PREFERRED NDD.

- The priority indicator (value 1 - 10) for each value of PREFERRED NDD.

The radio unit stores at least four PREFERRED NDD sub-field values, each of which is assigned a priority value between 1 (the highest priority) and 10 (the lowest priority).

The PREFERRED NDD sub-field data is unit specific and values are assigned to the radio unit to bias the unit towards operating on a control channel from where the unit may receive optimum service from the network. The choice of such PREFERRED NDDs should reduce the network loading by encouraging radio units with common interests to operate on common control channels. Suitable planning of the Preferred NDD sub-field data will increase the efficiency of the network by reducing the number of inter-site calls and also increase the success of group calls by increasing the probability that all users in one group will be served by control channels which serve that group call.

9.3.5 Optional Background Search Sequences

The radio unit is optionally allowed, whilst confirmed on a control channel, to hunt for other control channels and so gain information regarding SYS codes and signal strengths of the control channels that it discovers. The unit is then permitted to leave the control channel on which it is confirmed if certain criteria are met by the prospective control channels.

The network operator shall specify certain parameters which control the background search sequences. These are:

LM1 - The positive signal strength margin (in 6 dB steps, with a maximum of 40dB, of the sampled control channel over the confirmed control channel) between the confirmed control channel if it does not bear a Preferred NDD sub-set in the PREFERRED NDD sub-field and also where the confirmed control channel is less than or equal to L.2. and the sampled control channel where it does not bear a Preferred NDD sub-set in the PREFERRED NDD sub-field of the system identity code.

LM2 - The positive signal strength margin (in 6 dB steps, with a maximum of 40dB, of the sampled control channel over the confirmed control channel) between the confirmed control channel if it bears a Preferred NDD sub-set in the PREFERRED NDD sub-field and also where the confirmed control channel is less than or equal to L.2. and the sampled control channel where it bears an equal priority Preferred NDD sub-set in the PREFERRED NDD sub-field of the system identity code.

LM3 - The positive signal strength margin (in 6 dB steps, with a maximum of 40dB, of the sampled control channel over L.O.) if the sampled control channel bears a PREFERRED NDD sub-set in the PREFERRED NDD sub-field of the

system identity code and where the confirmed control channel does not bear a PREFERRED NDD sub-set in the PREFERRED NDD sub-field.

NS - The number of timed sampling activities that a radio unit shall carry out before identifying a control channel as a prospective control channel.

TL - The period, in 100 slot blocks with a maximum of 3000 slots or in 10 second blocks with a maximum of 310 seconds, between confirming a control channel and making the first sample hunt and similarly the period between sample hunts.

TH - The period, in slots with a maximum of 100 slots, that the radio unit is allowed to be away from the confirmed control channel whilst sampling other prospective control channels.

9.4 Control Channel Parameters

9.4.1 General Requirement

The network operator shall make available a set of parameters for radio unit personalisation purposes to assist radio units to select a value of SYS for verification during control channel acquisition and to allow them to assess the error performance of the control channel.

9.4.2 Time-Shared Indicator

The different characteristics of time-shared and dedicated (including frequency-cycled) control channels may result in different values of parameters being appropriate. Accordingly, to allow optimisation of parameters in networks which use both time-shared and dedicated control channels radio units may be personalised with two sets of control channel parameters, one of which is appropriate to time-shared control channels and the other to dedicated control channels. The network operator shall either provide two sets of the parameters detailed in 9.4.3 to 9.4.5 below, or shall declare that only a single set of parameters is required for his network.

In order to advise radio units which of the two sets of parameters are applicable to a particular control channel number, the network operator may nominate certain channel numbers as ones on which the radio unit is likely to encounter time-shared channels. This nomination is required for the personalisation of radio units (see 9.2.1 of MPT 1343). The TSC may also designate channel numbers as ones on which time-shared control channels are likely to be encountered in the following messages transmitted in the forward control channel:

CLEAR	(see 11.5.5.4.3)
MOVE	(see 11.5.5.4.4)
BCAST(SYSDEF='00000')	(see 11.5.5.4.5a)
BCAST(SYSDEF='00100')	(see 11.5.5.4.5e)
BCAST(SYSDEF='00101')	(see 11.5.5.4.5f)

Note that if no channel numbers are nominated as ones on which radio units are likely to encounter time-shared control channels, then radio units will utilise the parameters appropriate to dedicated control channels only.

9.4.3 Selection of SYS for Verification

The network operator shall specify for the purposes of radio unit personalisation the number of consecutive control channel system codewords which may be received with the same value of SYS field before that value of SYS field may be selected for verification (NV).

Two values shall be specified; one for use on channel numbers which have been nominated as ones on which time-shared control channels may be encountered and one for use otherwise (or the network operator shall state that only one value is required for his network).

9.4.4 Parameters for Error Performance Assessment

The network operator shall specify, for the purposes of radio unit personalisation, a number of parameters which define the characteristics of the forward control channel error checking procedures to be adopted by radio units.

Radio units carry out error checking measurements both before control channel acquisition and thereafter whilst receiving on the control channel. Different parameters define the characteristics in these two cases.

The parameters define the sample size to be used for each error check (in terms of contiguous received codeword periods), the number of errored codewords in a sample which must be exceeded to record an error event and the number of further samples to be taken after such an error event before appropriate action shall be taken.

Two values of each parameter shall be specified, one for use on channel numbers which have been nominated as ones on which time-shared control channel may be encountered and one for use otherwise (or the network operator shall state that only one value is required for his network).

9.4.5 Maximum Time Between CCSCs with Identical SYS Value

The network operator shall specify for the purposes of radio unit personalisation, the maximum time TS that the radio unit should assume will occur under normal operating conditions, between transmissions on the forward control channel of CCSCs which have identical values of SYS.

9.5 Broadcast Information

The TSC may utilise forward control channel message transmissions to convey information on control channel deployment to suitably equipped radio units by means of the BCAST message (see !!5.5.4.5!! of MPT 1327).

The following forms of the BCAST message are applicable for this purpose:

SYSDEF='00000' - This message announces a channel number that is in use by the network as a control channel (and, by implication, is not one of the normal hunt channel numbers).

SYSDEF='00001' - This message specifies a channel number that is no longer in use by the network as a control channel. (This may be a previously announced channel number or one of the normal hunt channel numbers).

SYSDEF='00100' - This message specifies the channel number of a control channel currently in use on a site adjacent to the one radiating the control channel on which the message was received.

SYSDEF='00101' - This message gives an opportunity to idle radio units to use the next slot for signal assessment of the control channel specified by the broadcast message. When transmitting this message the TSC shall refrain from using the following slot to signal to radio units that are likely to be assessing the signal strength received from the adjacent site.

10 REGISTRATION (Standard Option)

10.1 Registration in the network operating in the normal mode

Registration may occur in the network operating in the normal mode when:

i. a radio unit specifically requests registration, by the use of arandom access RQR message;

ii. a radio unit responds to a registration deamdn from the network;

iii. a radio unit participates in certain normal control channel signalling routines.

10.2 Registration Procedures

10.2.1 Registration request received by random access

On receipt of a random registration request the network may respond, within WAIT + 1 slot:

i. ACK, (QUAL = O) to accept the request,

ii. ACKX, (QUAL = 0) to reject the request,

iii. ACKX, (QUAL = 1) to fail the request,

or:

iv. ACKI, (QUAL = 1) to delay the response to the request.

Accepting the request shali result in the network up-dating its registration records for the requesting radio unit.

Rejecting the request may result in no change to the network registration records. The radio unit is barred from further registration attempts on the rejecting AREA code until it has been switched off and subsequently switched on.

Failing the request shall result in no-update to the network's registration records. The radio unit r4e-commences a random access registration attempt in accordance with section 8.2.2 of MPT 1327.

The intermediate acknowledgement, delaying the response, shall be followed by one of the other responses listed above with the appropriate network action to complete the process.

10.2.2 Registration request received when demanded by the network

On receipt of a demanded registration request the network may respond within WAIT + 1 slots:

i. ACK, (QUAL = 0) to accept the request.

ii. ACKX, (QUAL = 0) to reject the request.

Accepting the request shall result in the network up-dating its registration records for the requesting radio unit.

Rejecting the request may result in no change to the network registration records. The radio unit is barred from further registration attempts on the rejecting AREA code until it has been switched off and subsequently switched on.

The TSC shall not demand registration for any radio unit if the AREA code in the presently radiated SYS code from the TSC (see 9.3) is zero. In addition the TSC shall not demand registration from any radio unit if the network operator has assigned a value of zero to the length LA of the AREA sub-field (see 9.3.2.2).

10.2.3 Implicit Registration

When a radio unit participates in signalling transactions in an AREA which corresponds to:

a. a secondary registration AREA for the unit, then the network shall register the radio unit

or

b. an unregistered AREA for the unit, then the network may register the radio unit

if the call transaction obeys the requirements in either of sections 10.2.3.1 or 10.2.3.2.

10.2.3.1 Implicit registration of a calling radio unit

Random access messages other than RQR, RQX or RQQ hook signalling, which are received from radio units via control channels with any AREA code other than the code contained in the prime registration, shall result in an implicit registration if the network sends one of the following messages:

ACK (QUAL = '0')
ACK (QUAL = '1') if a call request is cancelled
ACKV
ACKE (QUAL = '0')
ACKT (QWAL = '0')
ACKB (QUAL = '0')
GTC

If the network does not implicitly register a unit which makes a call in an unregistered AREA it may refuse the call request and then demand a registration from the unit.

10.2.3.2 Implicit registration of a called radio unit

If the network receives a radio unit response of ACK (QUAL = '0') or ACKI (QUAL = '0') to an AHY message sent by the network from an AREA for which the network has a secondary registration for the unit, and the network sends GTC or AHYX to the radio unit in connection with the same call, the action shall result in an implicit registration.

11 GENERAL CONTROL PROCEDURES

The mandatory requirements of MPT 1327 are also mandatory requirements of this specification. MPT 1327 allows many options. This section specifies which such options are mandatory. The main mandatory requirements are to provide a control channel labelled with a defined system identity code, and to handle 2-party, common prefix, speech calls on a single base station using a common traffic channel effectively and efficiently.

The requirements are categorised as follows:

Mandatory	Each TSC shall implement the function or facility.
Standard Option	If a TSC implements the function, then it shall be implemented at least in the specified manner.
Available for customisation	Such functions shall not modify existing standardised functions.
Optional	The TSC may use the information or implement the facility at the discretion of the operator.
Informative	The corresponding section within MPT 1327 is primarily informative or related only to radio unit specifications, with no requirements on the TSC arising directly from the contents. However related requirements may be included in other sections.

The section numbers have been formed by prefixing the section numbers of MPT 1327 by "11.". Thus sub-sections here refer to, and should be read in conjunction with, the corresponding sections of MPT 1327.

11.1 Introduction

The entire chapter is informative.

11.2 Definitions

The definitions found in MPT 1327 and MPT 1343 apply to words and phrases within this specification.

11.3 Signalling Formats

All parts of this chapter which include specification material are mandatory except where they specifically refer only to radio units or the MARK address codeword. Use of the MARK address codeword is a standard option. All other parts of the chapter are informative.

11.4 Addressing

The TSC shall understand those special IDENTs required by mandatory call procedures, and also those required by any standard options which are implemented. The TSC shall conform with the numbering convention (see section 8).

11.5 Codeword Structures

a. Standardised fields

Mandatory as specified.

b. Reserved fields

Mandatory as specified.

c. MPT 1327 spare fields with defined use in MPT 1343

Mandatory that such fields shall be used only with the defined meaning.

d. Spare fields not defined in MPT 1343

Available for customisation in the manner specified.

11.5.1 Control Channel System Codeword (CCSC)

Mandatory usage. Each system identity code used shall have the format specified in section 9.3.2.

11.5.2 General Address Codeword Structures

Informative except categories marked "reserved". Reservation is mandatory.

11.5.3 List of address codewords

Informative except for types marked "reserved". Reservation is mandatory.

11.5.4 Go-to-channel message

Mandatory usage.

11.5.5.1 Aloha messages

Mandatory that either ALH or ALHS shall be used. Use of any or all of ALHE, ALHR, ALHX and ALHF is a standard option.

Mandatory to regard ALHD and FUNC '111' as "reserved".

Use of the WT, M, and N bit fields to achieve efficient traffic control should be considered.

11.5.5.2 Acknowledgement messages

Informative.

11.5.5.2.1 Acknowledgement messages sent by the TSC

Use of these messages is a standard option unless a standard facility option incorporated in the TSC requires their mandatory use.

11.5.5.2.2 Acknowledgement messages sent by radio units

Mandatory to receive acknowledgement messages from radio units in a simple 2-party, common prefix, same base station call, and take appropriate action. Understanding of these messages in all other circumstances depends on the standard options incorporated in the TSC.

11.5.5.3 Request and Ahoy messages

Informative.

11.5.5.3.1 and all sub-sections. Request messages

Mandatory to understand RQS and RQX in a simple, 2-party, common prefix, same base station call.

Understanding of these messages in all other circumstances depends on the standard options incorporated in the TSC.

11.5.5.3.2 and all sub-sections. Ahoy messages

Mandatory to send AHY to check availability of the called radio party in a 2-party call.

Transmission of these messages in all other circumstances depends on the standard options incorporated in the TSC.

11.5.5.4 Miscellaneous control messages

Informative.

11.5.5.4.1 MARK

Standard option.

11.5.5.4.2 Call maintenance message, MAINT

Mandatory to be able to understand MAINT, OPER='011'.

Transmission and/or understanding of all other MAINT messages depends on the standard options incorporated in the TSC.

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

Transmission and/or understanding of STI and SIL3 depends on the standard options incorporated in the TSC. See sections 11.9.2.3.3, 11.9.2.3.7 and 9.3.4.2.2 in MPT1343.

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

11.5.5.4.3 Clear-down message, CLEAR

Mandatory as specified.

The message format is as follows:

1	CHAN	CONT	1	CAT	TYPE	FUNC	STI	SIL3	TSI	SPARE	REVS 101010101010	1
1	10	10	1	3	2	3	1	3	1	1	12	1

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

TSI - Time shared control channel indicator. See section 9.4.2.

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

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

Transmission and/or understanding of STI and SIL3 depends on the standard options incorporated in the TSC.

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. See sections 11.5.5.4.3,

11.9.2.3.8, and 9.3.4.2.2 in MPT 1343.

SIL3 - the three least significant bits of the SIL sub field of the system identity code appropriate to the system originating the message. See sections 11.5.5.4.3, 11.9.2.3.8 and 9.3.4.2.2 in MPT 1343.

11.5.5.4.4 Move to Control Channel, MOVE

Standard option.

The message format is as follows:

1	PFIX	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 channel 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

Informative.

11.5.5.4.5a 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..4.2.

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

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

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

Standard option.

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

Standard option.

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

Standard option.

The message format is as follows:

1	SYSDEF 00011	SYS	1	CAT 000	TYPE 11	FUNC 100	RSFD	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 be prepared to store (see section 10 of MPT 1343):
'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

Note: the network may indicate "temporary mode" on a control channel when the integrity of registrations cannot be guaranteed.

RFFD - Reserved for future definition in MPT 1343.

Default value = '000000'

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

Standard option.

The message format is as follows:

1	SYSDEF 00100	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 9.4.2.

'0' - Time-shared control channel are not expected on channel number CHAN.
'1' - Time-shared control channels may be encountered on channel number CHAN.

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

Standard option.

The message format is as follows:

1	SYSDEF 00100	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 9.4.2.

'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 Message, 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

Reception of this message is to be understood if Mode 1, DESC = '000' (Interprefix calls) option is implemented.

Reception of this message is to be understood if Mode 2, DESC = '000' (Serial Number Transfer) option is implemented.

Standard option otherwise.

11.5.7 Codewords applicable to Standard data Call Set-Up

11.5.7.1 Request Standard Data Communication, RQD

Mandatory to recognise call request. Standard option to respond in any other manner than ACKX, QUAL=0.

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 Transaction

Entire sub-section: Standard option.

11.6 Channel Discipline

Informative.

11.6.1 and all sub-sections. Channel discipline for TSC

Mandatory where specified.

11.6.2 and all sub-sections. Channel discipline for radio units

Informative.

11.7 Random Access Protocol

Informative.

11.7.1 Principle

Informative.

11.7.2 and all sub-sections except 11.7.2.3. TSC Random access facilities

Mandatory where specified.

11.7.2.3 Inviting specific types of random access

Use of either or both ALH and ALHS is mandatory. All other Aloha messages are standard options.

11.8 Registration Procedures

Informative.

11.8.1 Registration facilities

Informative.

11.8.2.1 and all sub-sectins. TSC Random access registration procedures

Standard option. A TSC not using this option shall not send the ALH codewords.

11.8.2.2 and all sub-sections. Radio unit random access registration procedures

Informative.

11.8.3 and all sub-sections. Registration on demand

Standard option.

11.9 Basic Call Procedures

It is mandatory for the TSC to provide simple 2-party, common prefix, speech calls between radio units on the same base station.

All sub-sections of MPT 1327, section 9 relevant to the TSC (ie not informative) refer only to this mandatory class of call. All other types of call may be catered for as standard options.

11.9.1.1.1 Responses to a short addressing RQS message

Standard options.

11.9.1.1.2 and 3 Extended addressing procedures

Standard option.

11.9.1.1.4 Call set-up progress acknowledgements

Standard options.

11.9.1.1.5 Availability check on called radio unit

Mandatory with POINT = '0' to check availability of called radio unit in a 2-party call.

POINT = '1' is a standard option.

11.9.1.1.6 Land telephone answered check

Optional.

11.9.1.1.7 Availability check on requesting radio unit

Standard option.

11.9.1.1.8 Call cancellation

Mandatory where specified.

11.9.1.1.9 Call amalgamation

Mandatory where specified.

11.9.1.1.10 Queue management

First and second paragraphs are informative. Final paragraph is a standard option.

11.9.1.1.11 Resolving call conflicts

Informative.

11.9.1.1.12 Traffic channel allocation

Mandatory where specified.

11.9.1.2.1-4 Call maintenance and traffic channel replacement

Standard options.

11.9.1.2.5 Clearing down unwanted radio units

Standard option.

11.9.1.2.6 Call clear down

Mandatory where specified for every class of call facilitated. Otherwise standard options.

11.9.2 and all sub-sections Basic call procedures for radio units

Informative.

11.10 Emergency Call Procedures

Informative.

11.10.1 Standard emergency call procedures for TSC

Standard option.

11.10.2 Emergency call procedures for radio units

Informative.

11.11 Include Call Procedures

Informative.

11.11.1 TSC procedures for include calls

Standard option.

11.11.2 Include call procedures for radio units

Informative.

11.12 Call Diversion Procedures

Informative.

11.12.1 TSC procedures for call diversion requests

Standard option. If this option is exercised, the TSC shall incorporate measures to minimise waste of air-time due to the occurrence of unreasonable ACKT responses to callers. For example, by refusing any call diversion request to a destination which is already subject to call diversion, and/or by abandoning any call diversion to a destination when that destination itself becomes the subject of call diversion.

11.12.1 Call diversion procedures for radio units

Informative.

11.13 Status Message Procedures

Informative.

11.13.1 Procedures for status messages sent ot the TSC

Standard option.

11.13.2 Status procedures for radio units

Informative.

11.14 and all sub-sections. Short Data Message Procedures

Standard option or informative.

11.15 and all sub-sections. Data Interrogation Procedures

Standard option or informative.

11.16

This paragraph is not used.

11.17 Standard Data Procedures

Entire section: Standard option.

12 NON-STANDARD DATA

The provision of a non-standard data facility is a standard option. When non-standard data calls are requested (either by a RU and RQS, DT='1' or by a line unit or external service) the TSC shall set the D bit to '1' in all AHY and GTC messages for the call.

12.1 When carrying non-standard data traffic the TSC shall not expect to receive any call maintenance messages other than MAINT-OPER '011' from the radio unit.

13 FALL-BACK MODE (Standard Option)

13.1 Introduction

A TSC may enter fall-back mode whenever it becomes necessary to provide a restricted service due to failure conditions which would otherwise cause the affected TSC to cease service.

During fall-back each affected channel may be operated as an independent, single channel system which alternates between control channel operation (when it accepts random access call requests) and traffic channel operation.

13.2 Entering fall-back mode

The control channel(s) on the affected system cease(s) to transmit normal Aloha messages (ALH, ALHS, ALHD, ALHE, ALHR or ALHX) and send(s) instead ALHF messages (!!7.3.2!!). The channel(s) may continue to transmit the same CCSC as used in normal operation.

Other affected channels on the TSC may commence transmitting ALHF messages after a normal start-up sequence (!!3.3.3.1!!). All channels may transmit the same CCSC.

13.3 Procedures in fall-back mode

In fall-back mode operation the only Aloha message that shall be used is ALHF. Whilst in fall-back mode the system may accept the following types of call request: RQS, RQX, RQT, RQE, RQQ and RQC (%%13.4%%).

Call requests for which the system is able to provide service may be acknowledged by GTC with the fall-back channel as the allocated traffic channel. Availability checks need not be carried out on either the called or calling party.

13.4 Resuming normal control channel operation

Normal operation is resumed at the first opportune moment by the TSC establishing normal control channel(s), ie using ALH, ALHS, ALHD, ALHE, ALHR or ALHX, after which it may direct units to the appropriate control channel.

14 SHORT DATA ON THE CONTROL CHANNEL USING RQC

14.1 Introduction

This section describes the air interface requirements necessary to support signalling between radio units and TSCs during the transfer of short data messages on the control channel. The implementation of the procedures defined in this section is a standard option.

The transfer of short data messages conforms with the basic procedure defined in MPT1327 section 14. This allows transmission of HEAD messages containing free format data on the control channel. Implementation of the short data standard option defined in this document requires some of these bits to carry control information.

The protocol allows the use of only MPT1327 procedures, or the procedures as described in this section.

A calling radio unit requests to transmit a short data message by sending an RQC random access request message addressed to the called unit or service. For extended addressing PSTN and PABX calls (and optionally for interprefix calls), the TSC will solicit the full called party address information using the MPT1327 extended addressing procedures at an appropriate point in call set-up. The TSC may check the availability of a called radio unit using the General Availability Check Message AHY, before requesting the caller to send a HEAD message by means of the Short Data Invitation Message AHYC (refer to sections !!5.5.3.2.1!! and !!5.5.3.2.8!!). The calling party sends a Short Data Message Header HEAD and up to four appended data codewords to the TSC. The TSC then forwards the data by re-transmitting the HEAD message to the called party which is required to respond with an acknowledgement in accordance with the procedures outlined in section 14 of MPT1327. The TSC sends an acknowledgement to the calling party to advise the receipt of the HEAD message (or otherwise) by the called party. Where the called party is a group and not an individual address no acknowledgement by radio units in that group to a HEAD message is permitted (see section !!14.3.1.2!!) and, in this case, the TSC sends an acknowledgement to the calling party to advise whether the HEAD message has been received by the TSC and transmitted to the group.

Note: The term "HEAD message", where used in this section, shall be taken to mean "HEAD address codeword and appended data codewords" collectively.

The procedures defined in !!14!! support the transmission of a single segment of free-format data. (A "segment" is that amount of free-format data which can be accommodated in a single HEAD message; see section 3.1). This specification extends the scope of the above referenced procedures to allow up to four segments to be associated with a single request (RQC). For convenience a short data transaction for which the T-message (see section 3.1) is confined to a single segment is referred to as a Single Segment Transaction (SST) in this specification. A short data transaction for which the T-message comprises more than one segment is referred to as a Multiple Segment Transaction (MST).

14.1.1 General Description

A radio unit requests to transmit short data HEAD messages in accordance with the procedures of !!14!! by sending an RQC message on a control channel. The TSC then solicits the transmission of a HEAD message using the address codeword AHYC. In the case of a Multiple Segment Transaction, each HEAD message of the transaction is individually solicited by the TSC using an AHYC message. The TSC need not support Multiple Segment Transactions, in which case this will be indicated in the AHYC message. In these circumstances a radio unit wishing to send a T-message comprising more than one segment is required instead to generate an RQC for each segment treating each as an SST.

In the case of an MST, the TSC is responsible for requesting each segment from the radio unit and forwarding it to the called party. The TSC either will assemble the complete T-message before forwarding it or will forward each segment by means of a HEAD message as soon as it has been received correctly.

SSTs and MSTs may be addressed to individual units, to groups or to a TSC gateway.

A simple message repeat error correction protocol is incorporated into this specification. If an error is detected by the TSC in a return channel data codeword (calling radio unit to TSC) a repeat may be demanded until a satisfactory error-free segment can be assembled. If an error is detected by an individually called radio unit in a forward channel data codeword (TSC to called party), repeat transmissions may be requested. The TSC may make repeat transmissions, subject to timing rules and network limits, when no acknowledgement of receipt is obtained from the called party.

14.1.2 Facilities

T-messages may be sent in one of the 8 formats listed below. Changing between these formats within a transaction is not permitted.

- binary
- BCD (in accordance with MPT1327, Appendix 5)
- CCITT Alphabet No 2 (Telex), Recommendation S1
- CCITT Alphabet No 5 (ASCII), Recommendations V3 and V4
- two formats which are reserved for future definition
- two formats which are spare for customisation

A short data HEAD address codeword and appended data codewords may occupy up to three control channel timeslots. The data formats specified in this section allow an SST to convey 44 BCD characters, 35 CCITT Alphabet No 2 (Telex) characters or 25 CCITT Alphabet No 5 (ASCII) characters. An MST is capable of carrying 176 BCD characters, 140 CCITT Alphabet No 2 (Telex) characters or 100 CCITT Alphabet No 5 (ASCII) characters.

14.2 Message Formats

The proccdures for short data message transmission described in this section utilise MPT1327 address codewords and data codewords. The formats of the address codewords are as

prescribed in MPT1327 with, in the case of the AHYC codeword, some additional meanings ascribed to the values of one field within the codeword. The format of data codewords is not specified in MPT1327, but a data codeword structure is specified for the procedures in this section to allow control parameters to be incorporated and defined data character formats to be utilised.

These particular applications of address and data codewords are described below.

14.2.1 Short Data Invitation Message, AHYC

The format of this message is as specified in !!5.5.3.2.8!! with the following addition (note that IDENT1 shall be set to SDMI for inviting short data HEAD messages):

DESC: '000' TSC supports SSTs only. Instruction to calling party to send a HEAD message.

'1xx' TSC supports MSTs. Instruction to calling party to send a HEAD message containing the appropriate segment of the MST -

xx = value assigned to the short data segment.

xx = '00' - First segment of MST or only segment of SST.
xx = '01' - Second segment.
xx = '10' - Third segment.
xx = '11' - Fourth segment.

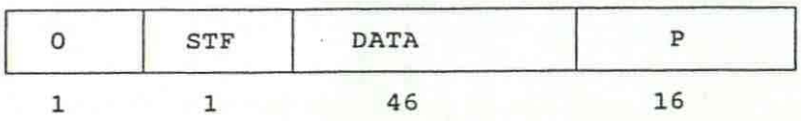
14.2.2 Data Codewords

14.2.2.1 General Structure

Up to four data codewords may be appended to a HEAD address codeword. Each data codeword shall conform to one of the following two general structures, depending on its position relative to the HEAD codeword:

i) First and third data codewords following the HEAD codeword:

MPT1327 Short Data Message Format (STF = '0')

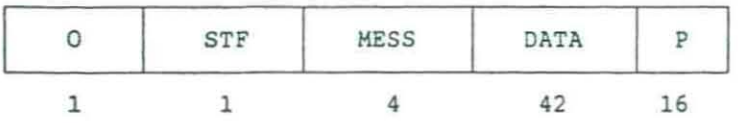


STF - Segment Transaction Flag.
'0' - MPT1327 short data message format (46 bits of free format data in each of up to 4 data codewords).

DATA - Free format binary digits.

P - Parity check bits.

MPT1343 Short Data Message Format (STF = '1')



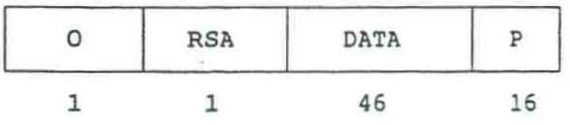
STF - Segment Transaction Flag. '1'- MPT1343 short data message format as defined in this specification).

MESS - Message Control Field (refer to 14.2.2.2).

DATA - Free format binary digits or binary-encoded free format text (refer to 14.2.2.3).

P - Parity check bits.

ii) Second and fourth data codewords following the HEAD codeword:



RSA - Return Slot Access Flag. When transmitted by the TSC on a control channel:

'0' - Radio units shall not attempt random access in the following slot on the return control channel.

'1' - Radio units may attempt 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'.

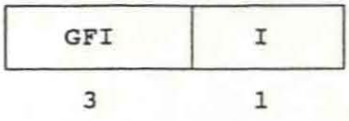
DATA - Free format binary digits or binary-encoded free format text (refer to 14.2.2.3).

P - Parity check bits.

14.2.2.2 Structure of MESS Field

The format of the MESS field shall conform to one of the following two structures, as determined by the position of the data codeword containing the MESS field relative to the HEAD codeword:

i) First data codeword following the HEAD codeword:



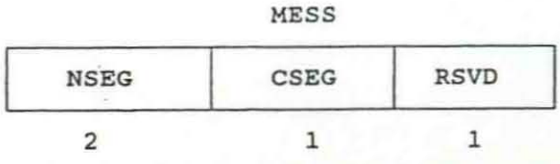
GFI - General Format Information, states the format in which the T-message is presented in the DATA fields of this and subsequent data codewords (see also 14.2.2.3).

- '000' Binary.
- '001' BCD (Appendix 5, MPT1327).
- '010' CCITT Alphabet No 2 (Telex).
- '011' CCITT Alphabet No 5(ASCII).
- '100', '101' Reserved.
- '110', '111' Spare.

I - Initial Segment flag.

- '1' First segment.
  (For an SST, I shall always be set to '1')
- '0' Subsequent segment.

ii) Third data codeword following the HEAD codeword:



NSEG - Indicates the number of segments to follow in an MST.

- '00' Last segment.
- '01' One segment to follow.
- '10' Two segments to follow.
- '11' Three segments to follow.

(For an SST, NSEG shall always be set to '00' where this codeword is used.)

CSEG - Indicates whether the message containing the next segment of an MST requires 2 or 3 control channel timeslots.

- '0' Two slots required.

- '1' Three slots required.
(Where NSEG = '00', CSEG shall be set to '0'. Where NSEG = '10' or '11', CSEG shall be set to '1'.)

RSVD - Reserved for future definition.

14.2.2.3 Structure of DATA Field

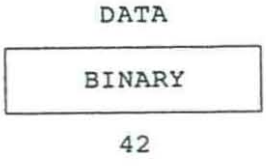
The format of the DATA field shall be determined by the value of the GFI field and shall be as specified below.

Note: In the formats given below, "n*" represents the most significant bits of an encoded character whose remaining bits form the start of the DATA field of the next codeword. "*m" represents the m least significant bits of an encoded character whose preceding bits concluded the DATA field of the previous codeword.

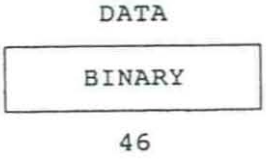
i) Binary

(GFI = '000')

First and third codeword:



Second and fourth codeword:

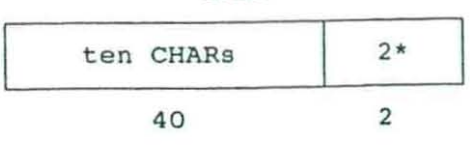


BINARY - Free format binary data.

ii) BCD (as in Appendix 5 of MPT1327)

(GFI = '001')

First codeword:



Second codeword:

DATA

*2	eleven CHARs
2	44

Third codeword:

DATA

ten CHARs	2*
40	2

Fourth codeword:

DATA

*2	eleven CHARs
2	44

CHAR - Binary value, as prescribed in MPT1327 Appendix 5, of unspecified BCD character.

Note: The maximum number of BCD characters which can be included in a segment is 44.

iii) CCITT Alphabet No 2 (Telex Type Characters)

(GFI = '010')

First codeword:

DATA

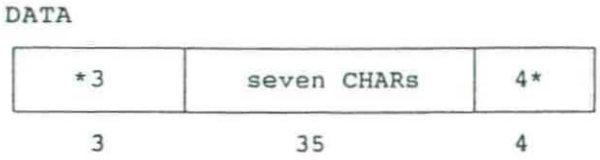
SPARE	eight CHARs	1*
1	40	1

Second codeword:

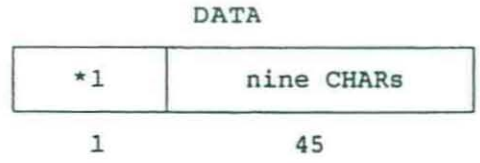
DATA

*4	eight CHARs	2*
4	40	2

Third codeword:



Fourth codeword:



SPARE - Available for customisation.

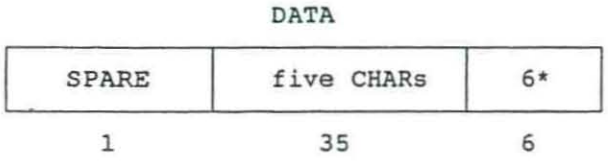
CHAR - Binary value, as prescribed in CCITT Recommendation S1 (Alphabet No 2), of an unspecified character.

Note: The maximum number of CCITT Alphabet No 2 characters which can be included in a segment is 35.

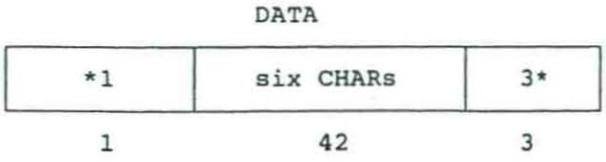
iv) CCITT Alphabet No 5 (7 bit ASCII)

(GFI = '011')

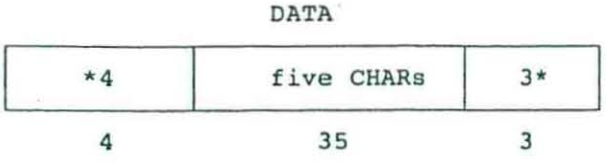
First codeword:



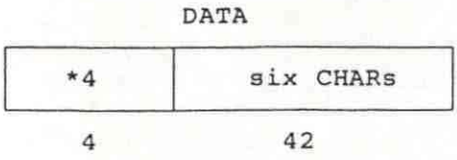
Second codeword:



Third codeword:



Fourth codeword:



SPARE - Available for customisation.

CHAR - Binary value, as prescribed in CCITT Recommendation s V3, V4 (Alphabet No 5), of an unspecified character.

Note: The maximum number of CCITT Alphabet No 5 (7 bit ASCII) characters which can be included in a segment is 25.

v) Other formats

Formats for GFI values of '100' and '101' are reserved for future definition. Formats for GFI values of '110' and '111' are spare for customisation.

14.3 The Use of Control Fields for STF = '1'

A calling radio unit divides its T-message into a maximum of four segments, where all segments except the last utilise exactly four data codewords. The last segment may utilise up to four data codewords as required to accommodate the T-message. The segments of a Multiple Segment Transaction are logically linked by the 'NSEG', 'CSEG' and 'I' fields.

A HEAD message containing the first segment shall have the I bit set to '1', and those containing subsequent segments shall have I set to '0'.

The NSEG field represents a decrementing counter which shall indicate the number of segments to follow to complete the transaction such that the value of NSEG is '00' for the last segment of an MST. If the last segment uses less than three data codewords, then the NSEG field will not be transmitted and the recipient shall behave as though its value had been '00'.

The CSEG field informs the TSC of the number of slots required for data codewords containing the next segment. The value shall always be '1' when transmitted with leading segments (NSEG = '10' or '11') and may be either '1' or '0' when transmitted with the penultimate segment (NSEG = '01'). With the final segment CSEG defaults to '0' and the TSC shall ignore the value.

HEAD messages transmitted by the TSC to a called radio unit or group shall contain the same values of I, NSEG and CSEG as those of messages containing the corresponding segments received by the TSC from a calling radio unit.

In the case of a T-message not originated by a radio unit the TSC shall construct HEAD

messages as appropriate with control fields set to values consistent with the above requirements.

An example, illustrating the use of the Control fields, is given in 14.5

14.4 TSC Procedures

It is a standard option for the TSC to support short data messages (either SSTs only or MSTs). A TSC which implements this option shall comply with the requirements of !!14.1!!. In addition, this TSC shall meet the following requirements.

14.4.1 Instruction to Send HEAD Message(s)

After receiving an RQC message (see !!14.1.1!! and !!14.1.2!!), the TSC may demand a short data message from the calling radio unit by sending the AHYC message, as in !!14.1.4!! except with the DESC and SLOTS values set as indicated below. If the TSC does not successfully decode a HEAD message, it may repeat the AHYC message with the same DESC value. The TSC may use repeated transmissions of the radio unit's HEAD message, each transmission of which may contain corrupted data codewords, to assemble a complete and uncorrupted segment.

If the TSC cannot accept MSTs, it shall set the DESC field in the AYHC message to '000' and the SLOTS field to SLOTS from the RQC, as defined in !!14.1.4!!.

If the TSC can accept MSTs, it shall set the DESC field in the first AHYC message (and any repeats thereof) to '100', and the SLOTS field to SLOTS from the RQC. If the TSC successfully receives a segment which contains NSEG not equal to '00' (thus indicating that the radio unit has a further segment to follow), the TSC may demand the next segment of the T-message by sending AHYC with:

- DESC incremented by one; and
- SLOTS set to '11' if the received HEAD message contained CSEG = '1' else SLOTS set to '10'.

The TSC may continue this process until it has received the last segment (with LEN < '10' or NSEG = '00').

14.4.2 Flag STF in Received HEAD Message

If flag STF in a received HEAD message is set to '0' (see 14.2.2), then the TSC behaviour shall be in accordance with 14.1 of MPT1327 but any additional procedures shall be system dependent.

If flag STF in a received HEAD message is set to '1', then the procedures in this specification shall apply.

14.4.3 Availability Check on Called Radio Unit

Before sending a data message, the TSC may send an AHY message with IDENT2 = SDMI to check the availability of an individually called radio unit (see !!14.1.6!!). Note that this AHY message starts the radio unit's individual incoming short data timer at value TA - see %%14.4.2.1.1%%. This timer may be refreshed by further transmissions of the AHY message.

14.4.4 Sending Short Data to Individual Radio Unit

The TSC transmits a short data message to an individual radio unit by sending the HEAD message on a control channel, as defined in !!14.1.7!!. If the TSC does not successfully decode a response, or if the response is ACKB(QUAL=1), it may repeat the HEAD message with all fields unchanged.

For an MST, the TSC shall complete successful transmission of one segment before transmitting the next segment. The segments shall be transmitted in the order in which they were received from the source.

The TSC shall take into account the operation of the radio unit's individual incoming short data timer in sending further signalling for the short data transaction, including any repetitions that may be required in the event of signalling failure - see %%14.4.2.1.3%%. This timer is set:

- to a value TGI when the radio unit accepts a HEAD message; or
- to a value TA when the radio unit accepts AHY (IDENT2=SDMI).

While this timer is running, the radio unit will:

- reject HEAD messages from a second calling address; and
- assume that HEAD messages with the same calling address are part of the same short data transaction.

When this timer expires, the radio unit will assume that further short data signalling is for a new transaction.

Accordingly it is recommended that:

a) The TSC does not send any further signalling for the short data transaction later than:

i) the appropriate period (TA or TGI), less the tolerance on the radio unit's timer, following the last acknowledged message it sent for this transaction (AHY or HEAD);

or

ii) a period TGI less tolerance, following the first of any unacknowledged HEAD

messages sent after the last acknowledged message it sent for this transaction (ie the message referred to in i));

or

iii) a period TA, less tolerance, following the first of any unacknowledged AHY messages sent after the last acknowledged message it sent for this transaction (ie the message referred to in i));

whichever is the sooner.

b) The TSC does not send a new short data message to the same individual address within:

i) a period TGI, plus tolerance, following the last HEAD message it sent for this transaction;

or

ii) a period TA, plus tolerance, following the last AHY message it sent for this transaction;

whichever is the later.

14.4.5 AHYX Message

The TSC may inform an individually called radio unit of abortion of a short data transaction by sending the AHYX message with PFIX/IDENT1 as the called unit's address and IDENT2 set to SDMI. The TSC may repeat the AHYX message if it is not acknowledged by an ACK(QUAL=1) message from the called unit.

14.4.6 Sending Short Data to a Group

The TSC transmits a short data message to a group (or to all radio units) by sending the HEAD message on a control channel, as defined in !!14.1.7!! The called units do not respond, and the TSC may repeat HEAD messages to increase the probability of successful receipt.

For an MST, the TSC shall complete transmission of one segment before transmitting the next segment. The segments shall be transmitted in the order in which they were received from the source.

The TSC shall take into account the operation of the radio unit's group incoming short data timer in sending further signalling (repeats or further segments) for the short data transaction. This timer is set to a value TGG when a radio unit accepts a HEAD message for one of its group addresses - see %%14.4.2.2.2%%.

While this timer is running, the radio unit will:

- ignore HEAD messages addressed to this group from a second calling address; and
- assume that HEAD messages addressed to this group and with the same calling address are part of the same short data transaction.

When this timer expires, the radio unit will assume that further short data signalling addressed to this group is for a new transaction.

Accordingly it is recommended that:

a) The TSC sends the complete T-message, from the first transmission of the first segment to the last transmission of the final segment, within a period TGG, less tolerance.

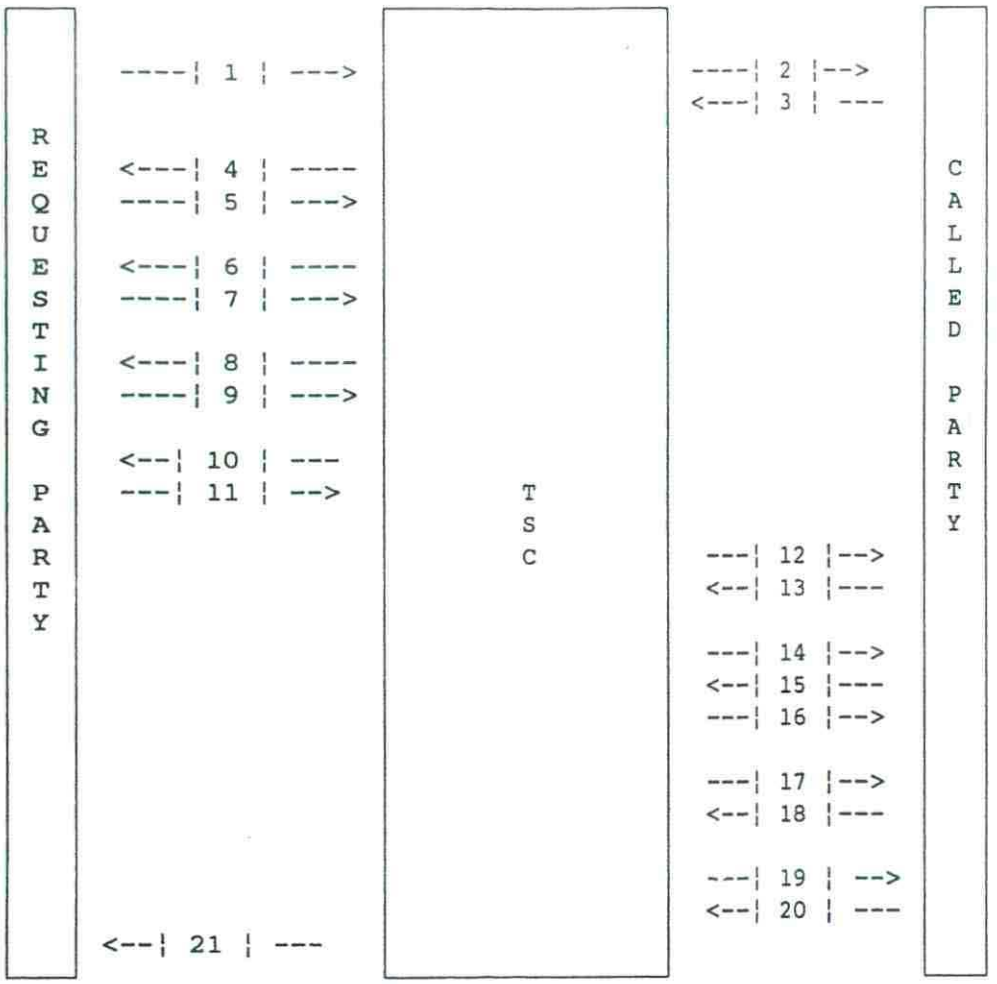
b) The TSC does not send a new short data message to the same group address within the same period, or within a period TGG, plus tolerance, following the last transmission of the final segment.

14.5 An Example of The Procedure for Extended Data Messages

In order to illustrate the use of the procedure in section 14, a typical message interchange is shown in Figure 14.1. The example shows a successful Multiple Segment Transaction linking three segments. An SST would be similar to the transmission of the first segment of the MST, but with the appropriate field values changed in the HEAD message. This example is illustrative only and does not form part of the specification.

In the example, an availability check is carried out on the called radio unit and some segment repeats are shown.

Figure 14.1 - Example of Successful MST Transaction



Descriptions of message interchanges

|1|: An RQC message requests a short data transaction (Assuming extended addressing is not required). The value of SLOTS in the RQC is '11', indicating that three slots are required for the HEAD message containing the first segment of the MST.

|2|: An AHY (POINT=0) message checks the availability of the called radio unit (optional).

|3|: An ACK (QUAL=0) message indicates general acknowledgement of the AHY.

|4|: Any AHYC message is sent to the requesting radio unit with DESC set to '100'. The first bit of DESC indicates that MSTs are supported. The second and third bits indicate that the first segment is required. SLOTS is set to '11' to indicate that three slots have been reserved for the HEAD message containing the first segment of the T-message.

|5|: A HEAD message containing the first segment of the MST is sent. The GFI field indicates the format of the T-message data. NSEG = '10' indicates that two more segments are yet to be sent. CSEG = '1'indicates that three slots are required for the HEAD message containing the next segment.

|6|: An AHYC message with DESC '101' solicits a HEAD message containing the second segment of the MST. SLOTS is set to '11' to indicate that three slots have been reserved for the HEAD message.

|7|: A HEAD message containing the second segment of the ST is sent. NSEG = '01' indicates that one more data segment is to be sent. CSEG = '0' indicates that two slots are required for the HEAD message containing the next segment.

|8|: An AHYC message with DESC = '101' solicits a repeat of the second segment of the MST. SLOTS is set as in |6|.

|9|: A HEAD message containing the second segment is retransmitted as in |7|.

|10|: An AHYC message with DESC = '110' solicits a HEAD message containing the third segment of the MST. SLOTS is set to '10' to indicate that two slots have been reserved for the HEAD message.

|11|: A HEAD message containing the third segment of the MST is sent. Since the message only contains two data codewords, NSEG (which is transmitted in the third codeword when present) is not sent. The TSC behaves as though its value had been '00'.

|12|: The TSC sends a HEAD message containing the first segment of the MST to called party. LEN is set to '11' to indicate that four data codewords are appended to the HEAD codeword and NSEG in the third appended data codeword is set to '10' to indicate that two segments of the MST are to follow.

|13|: An ACKB (QUAL=1) message indicates that the called party required the first segment to be transmitted.

|14|: The TSC sends a HEAD message containing a repeat of the first segment as in |12|.

|15|: An ACK (QUAL=0) message indicates successful receipt of the HEAD message by the called radio unit.

|16|: The TSC sends a HEAD message containing the second segment of the MST. LEN is set to '11' to indicate that four data codewords are appended to the HEAD codeword and NSEG in the third appended data codeword is set to '01' to indicate that one segment of the MST is to follow.

|17|: No acknowledgement is received by the TSC in the subsequent slot so a HEAD message containing a repeat of the second segment is transmitted as in |16|.

|18|: An ACK (QUAL=0) message indicates successful receipt of the HEAD message by the called radio unit.

|19|: The TSC sends a HEAD message containing the final segment of the MST. LEN is set to '01' to indicate that two data codewords are appended to the HEAD codeword. Since the message only contains two data codewords NSEG (which is transmitted in the third codeword when present) is not sent. The radio unit behaves as though its value had been '00'.

|20|: An ACK (QUAL=0) message indicates successful receipt of the HEAD message by the called radio unit.

|21|: An ACK (QUAL=0) message is sent by the TSC to the calling party to indicate that the transaction has been successfully completed. This acknowledgement may be repeated for reliability.

APPENDIX A

A.1 Approval Arrangements

An application for approval of a Trunking System Controller (TSC)* to MPT 1347 shall consist of:

1. A Declaration
2. A copy of the Certificate of Type Approval to MPT 1323.

Appendix B contains a sample of the Declaration to be submitted. The applicant must give certain information about the TSC and the test procedures in this Declaration.

The test procedure must be carried out at a named place(s) of business of the manufacturer or his agent by a named test engineer/technician. The test procedure may form part of the customer acceptance tests. A schedule of facilities to be tested is at Appendix C. The test results must be given for each test.

If practicable the Radiocommunications Agency should have 2 weeks notice of when the tests are to be carried out and should be invited to witness the tests at their discretion. The Agency shall also have access to the testing engineer to make other enquiries concerning the test procedures if they so wish.

The Declaration shall include a statement signed by the manufacturer's Quality Assurance Manager, or person designated by the directors to have responsibility for QA, who shall declare that the arrangements for the tests and the test procedures were implemented under his supervision.

The Declaration shall also include a statement signed by a Chartered Electrical Engineer who shall declare that the TSC tests were supervised by him and also declares that the tests were fairly, accurately, and comprehensively done that a true summary of the results is included in the Declaration, and that the TSC has been designed in accordance with MPT 1347.

The Agency shall issue a numbered approval certificate which states the TSC model and type number(s) and date of issue.

A.2 Design changes

Design changes or modifications which do not affect the ability of the TSC to function according to MPT 1347, or are intended to upgrade the software or hardware, and do not impact the original Declaration, need not be notified and approved.

* A TSC is defined as the central control intelligence necessary to enable the trunking system to function according to MPT 1347. Other functions such as control of connections to a wired network, or a billing function etc, are not the subject of this approval.

A.3 Address for Approval Applications

The address for applications for approval is:

Radiocommunications Agency
Room 514
Waterloo Bridge House
Waterloo Road
LONDON
SE1 8UA

DTI/RA

APPENDIX B

B1 Declaration to be completed when applying for an MPT 1347 Approval Certificate

B2 APPLICATION FOR MPT 1347 APPROVAL CERTIFICATE

I hereby apply for an Approval Certificate for the Trunking System Controller described in Section 3. I understand the Radiocommunications Agency may make further enquiries concerning this application, the Trunking System Controller, and the test procedures before granting or not granting approval.

Signed _____ Date _____

on behalf of _____

Name _____

Address _____

_____

_____

Declaration

All sections must be completed.

1 Trunking System Controller Manufacturer(s) (Give full name and business address)

2 Place(s) where the tests were carried out. (Give full address(s) if different from above).

3 Trunking System Controller (TSC) for which Approval Application is made: Manufacturer's Designation(s). (If a TSC has more than one such designation then all shall be stated.)

MPT 1347 Manufacturer's code:
MPT 1347 Model Code(s):
MPT 1323 Type Approval Number: RTD

Detail all MPT 1347 Standard Options supported. (If none enter 'none'.)

4 Date(s) tests carried out:

5 Test Engineer/Technician carrying out tests. (Give full name and job title. If there are more than one, all names must be stated.)

6 I declare that the arrangements for the tests and the test procedures were implemented properly under my supervision.

Signature _____ Date _____

Name _____ Job Title _____

(Manufacturer's Quality Assurance Manager or, alternatively, a person designated by the directors to have responsibility for QA.)

8 I declare that the tests on the Trunking System Controller (TSC) were carried out under my supervision, and do also declare that the tests were fairly, accurately, and comprehensively carried out and that a true summary of the test results is included in Section 10.

I do further declare that to the best of my knowledge the TSC has been designed to function fully in accordance with the requirements of MPT 1347 listed in Appendix C of MPT 1347.

Signature _____ Date _____

Name _____ Job Title _____

(Chartered Electrical Engineer with responsibility for TSC self-certification tests.)

9 Details of Test Equipment

The manufacturer shall give full details of the test equipment used which in part may include the use of MPT 1343 approved radio units, with explanatory diagrams if necessary, and shall detail how the equipment was used.

10 Details of Test Results

The Applicant shall indicate the test results as follows:

Indicating PASS shall mean the TSC fully complied with test requirements.

Indicating OPTION NOT FITTED shall mean the test refers to a standard option. The test was not carried out because the TSC does not support this option.

APPENDIX C

SCHEDULE OF TSC FACILITIES TO BE TESTED

Unmarked references refer to MPT 1347. References enclosed !! !! are found in MPT 1327.

C.1 MANDATORY FACILITIES

Reference	Title	Notes
4 (all)	Transmission	
MPT 1323, 6.2	Data Tolerances	Phase accuracy of Data Element Boundaries to be demonstrated
5 (all)	Reception	Data reception to be at least as good as in MPT 1343
9.1, par 3	Spectrum Efficiency	Capability to be demonstrated (not necessarily by a test)
9.3.2	SYS Codes	
11 (all)	MPT 1327conformity	All parts marked "mandatory" for all types of call provided
11.5.5.1	ALH or ALHS	At least one of these messages shall be used
11.5.5.4.2 (part)	Disconnect message	Understanding of MAINT OPER='011', see also 11.9.1.2.6 below
11.9	Individual calls	Mandatory only for speech calls on same base station
11.9.1.1.8	Call cancellation	
11.9.1.2.6	Call clear-down	

C.2 STANDARD OPTIONAL FEATURES AND FACILITIES

Only those standard options included in a TSC need be tested.

Reference	Title	Notes
7	Security	
8.2.1(i)	Call set-up restriction Speech call 2 bases Call 2-prefix Conversational Group Calls Announcement Group Calls System-wide calls Call to-from line units	
8.2.1(ii)	Calls to/from PABXs Calls from PSTN Prearranged calls to PSTN	
8.2.1(iii)	General calls to PSTN Status (RQQ) calls Short data calls	On control channel. Awaiting facility specification RQS, DT=1
	Non-standard data calls Call back Include calls	See !!11.1!! for details RQE calls. If option provided RQE call logging is MANDATORY
8.3 + 11.12.1	Call diversion	See !!12.1!! for details
	Call queueing messages Set-up progress messages	(Full OACSU)
11.5.5.4.2	MAINT messages	All except MAINT, OPER='011' (see mandatory list)
11.9.1.2.4	Traffic channel replacement	
13	Fall back mode	