

LASAT

MODEM MANUAL

144-Series User's Reference

LASAT MODEM

144-SERIES

USER'S REFERENCE

TABLE OF CONTENTS

1. Introduction	1-1
2. Functional Description	2-1
2.1 Obtaining an Asynchronous Connection.	2-1
2.1.1 Auto Dial, Number is Entered.	2-2
2.1.2 Auto Dialling, Pulse or DTMF.	2-3
2.1.3 Auto Dialling, through PABX, Number is Entered.	2-4
2.1.4 Auto Dialling, Using a Stored Number.	2-5
2.1.5 Manual Dialling.	2-5
2.2 Disconnecting an Asynchronous Connection.	2-6
2.3 Answering Function.	2-7
2.3.1 Auto Answering Function.	2-8
2.3.2 Manual Answer.	2-8
2.4 Description of Constant Rate and Flow Control.	2-9
2.5 Configuration of the Modem.	2-9
2.5.1 Command and Result Code Form.	2-11
2.5.2 Internal Loudspeaker.	2-12
2.5.3 Identification of the Modem.	2-13
2.6 Special facilities.	2-13
2.6.1 Number Sending Facility.	2-13
2.7 Establishing a Synchronous Connection.	2-14
2.7.1 Manual Call, Connection controlled by DTR, Synchronous Connection.	2-15
2.7.2 Auto Dialling, Controlled of DTR, Synchronous Connection	2-15
2.7.3 Auto Call, Number is Entered, Synchronous Connection	2-16
2.7.4 Disconnect Synchronous Connection.	2-16
2.7.5 Mixed Synchronous and Asynchronous Operation.	2-17
2.7.6 Auto Answer, Synchronous Operation.	2-17
2.8 Establishing an Error Correcting/Data Compressing Connection.	2-17
2.8.1 Answer Modem with Negotiation and Hardware Flow Control	2-18
2.8.2 Auto Answer, Synchronous Operation.	2-19
2.8.3 V.42 Modem with Compulsory MNP or LAP-M.	2-17
2.8.4 V.42 and Test.	2-20
2.9 V.25bis Command Interpreter	2-21
2.9.1 Calls with V.25bis.	2-21
2.9.2 Answer with V.25bis.	2-22
2.9.3 Disconnection of Connection in V.25bis.	2-23
2.10 Remote Config	2-23
2.10.1 Remote Config between two LASAT 144-series Modems	2-23

2.10.2 Remote Config between a LASAT 144-series Modem and another Hayes Compatible Modem	2-26
2.11 Dial Back	2-28
2.11.1 Dial Back with Return Call	2-28
2.11.2 Dial Back without Return Call	2-29
3. Command Language	3-1
3.1 AT Command Guidelines	3-1
3.1.1 AT Commands, DTE Adaption	3-1
3.1.2 AT Command Format	3-1
3.1.3 Escape Code Sequence	3-2
3.1.4 AT Command Set	3-3
3.2 V.25bis Command Set	3-38
3.2.1 DTE/DCE Interchange Circuits	3-38
3.2.2 Formats for Commands and Indications	3-39
3.2.2.1 Synchronous Signalling	3-39
3.2.2.2 Asynchronous Signalling	3-41
3.2.3 V.25bis Escape Code Sequence	3-42
3.2.4 Standard V.25 Bis Commands	3-42
3.2.5 Extended V.25 Bis Commands	3-46
3.2.6 Standard V.25 Bis Indications	3-46
3.3 Fax Class 1 Commands	3-48
3.3.1 Fax I/O Processing	3-48
3.3.1.1 DTE-to-Modem Transmit Data Stream	3-48
3.3.1.2 Modem-to-DTE Receive Data Stream	3-48
3.3.1.3 Fax Mode Selection	3-48
3.3.1.4 Fax Origination	3-49
3.3.1.5 Fax Answering	3-49
3.3.1.6 Fax Control Transmission	3-50
3.3.1.7 Fax Control Reception	3-50
3.3.1.8 Fax Data Transmission	3-53
3.3.1.9 Fax Data Reception	3-53
3.3.2 Commands	3-54
3.3.3 Examples	3-59
3.4 Fax Class 2 Commands	3-62
3.4.1 Command Syntax and Guidelines	3-62
3.4.1.1 DTE Commands	3-62
3.4.1.2 Serial Port Speed and Flow Control	3-65
3.4.1.3 Auto Answer	3-66
3.4.1.4 Identification of T.30 Options	3-66
3.4.1.5 Session Status Reporting	3-67
3.4.1.6 Procedure Interrupt Negotiation	3-67
3.4.2 Service Class 2 Identification and Selection	3-67
3.4.3 Service Class 2 Action Commands	3-68

3.4.4 Service Class 2 DCE Responses	3-80
3.4.5 Service Class 2 Parameters	3-83
3.4.6 Example Sessions	3-91
4. Testing the Modem and the Telephone Line	4-1
4.1 Termination of Test	4-3
4.1.1 Limited Test	4-3
4.1.2 Disconnection of Ongoing Test	4-3
4.2 Local Test (CCITT V.54 loop 3)	4-3
4.2.1 Local Analog Loop	4-4
4.2.2 Local Analog Loop with Self Test	4-4
4.3 Remote Digital Loop (CCITT V.54 loop 2)	4-5
4.3.1 Remote Digital Loop	4-6
4.3.2 Remote Digital Loop with Self Test	4-7
4.4 Accept Remote Digital Loop	4-7
4.5 Rejection of Remote Digital Loop	4-8
4.6 Local Digital Loop	4-8
5. Error Correction and Data Compression	5-1
5.1 Rate Converting	5-3
5.2 Flow Control	5-4
5.3 Test and Error Correction	5-5
5.4 MNP10	5-6
6. Synchronous Data Signalling	6-1
6.1 Synchronous Clock Signal	6-1
6.2 Establishing a Synchronous Connection	6-1
6.2.1 Asynchronous Command Mode	6-2
6.2.2 DTR controlled Synchronous Connection	6-2
6.3 V.24 Signalling during Synchronous Establishment	6-3
6.4 AutoSync	6-4
Appendix	A-1
A.1 S-Registers	A-1
A.1.1 Factory Defaults	A-1
A.1.2 S-Register Definitions	A-4
A.2 Cables	A-25
A.2.1 RS232 Asynchronous/Synchronous cable connections	A-25
A.2.2 RS232 Asynchronous cable connections	A-26
A.3 Decoding of bitrelated registers	A-27

A.4 Result Codes	A-29
A.5 Abbreviated Command Survey.	A-31
Index	I-1

© Copyright LASAT COMMUNICATIONS A/S
33420099 - V931104

AutoSync® is a registered trademark for Hayes Microcomputer Products Inc.
HAYES® is a registered trademark for Hayes Microcomputer Products Inc.
MNP® is a registered trademark for Microcom Inc.

1. Introduction.

LASAT 144-series modems are a series of external and internal modems. The external modems are designed for connection to Data Terminal Equipment with CCITT V.24 or EIA RS-232C asynchronous or synchronous interface.

The internal modems are designed for connection to several PC, Notebook and Laptop bus interfaces.

The LASAT modem communicates on two-wire telephone lines in accordance with V.23, V.21, V.22, V.22bis, V.32 and V.32bis.

Furthermore, the LASAT modem comprises V.42, MNP2-4 (error correction) and V.42bis MNP5 (data compression) which for asynchronous connections renders 100% error free transmission of data and a possibility of doubling the transmission rate.

The standards are specified by CCITT as auto dialling and auto answering modem. The LASAT modem can be controlled by the AT command set, which makes it possible to make use of all the functions of the modem by commands entered from an asynchronous connection.

The LASAT modem can control calls and parameters for asynchronous calls via CCITT V.25bis command interpreter.

LASAT 144 series modems also comprise AutoSync. AutoSync provides your LASAT modem with the capability to communicate synchronously from an asynchronous port without a synchronous interface adapter card.

The LASAT modem has built-in test facilities and line monitor function which increase the possibility of locating possible errors, if the modem does not establish connection.

Furthermore, it is possible to configure a remote modem via the telephone line.

This manual comprises a functional description, and furthermore there is a description of the commands used for controlling the various facilities of the modem, such as error correction and data compression.

It is recommended that the user has read the installation guide of the LASAT modem.

This manual is organized as follows:

Chapter 2, "Functional Description" describes the use of the LASAT modem's command set. This chapter is supplied with examples describing the commands.

Chapter 3, "Command Language" is an exposition of each AT command. This chapter can later on be used as a reference guide.

Chapter 4, "Testing the Modem and the Telephone Line" shows various procedures for testing a modem connection.

Chapter 5, "Error Correction and Data Compression" is a brief exposition of the contents of error correction and data compression.

Chapter 6, "Synchronous Data Signalling" including AutoSync.

The "Appendix" contains a summary of cables, technical data and S-registers.

2. Functional Description.

In this chapter the use of the LASAT modem's command set is described. This chapter is meant to be used as a reference book, when a specific function is to be used.

If a communication software package is used which is capable of controlling the modem in accordance with the AT command set, it is recommended to use this method, rather than the one described below. Please note that most communication programmes are able to insert an initializing string which is sent to the modem when it is started.

The command set provides the user with the possibility of controlling all the facilities of the LASAT modem. Among these, the following can be mentioned: auto dial function, auto answer function, data rates at 75, 300, 600, 1200, 2400, 4800, 9600, 12000, 14400 bps, control of monitoring function and test facilities (chapter 4), error correction and rate converting on the modem. If more than one command in a single command line is stated, the commands are separated by spaces in order to facilitate the readability. However, when entering the command, it is not necessary to type the space, as the modem will ignore this. A command is completed by the sign <CR> to indicate that 'carriage return' (enter) must be activated. The result codes displayed are based on the assumption that the active configuration of the LASAT modem corresponds to factory configuration 1. To obtain a specified description of the command set, see chapter 3.

Configuration of the modem is performed by means of commands sent asynchronously to the modem from the computer using a terminal programme. The LASAT modem is capable of understanding commands at data rates of 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 and 57600 bps. The characters must have a word length of 9, 10 or 11 bits.

2.1 Establishing an Asynchronous Connection.

When establishing a connection via the telephone network, it is necessary to make a call to another modem. The LASAT modem can place a call to a telephone number which is either typed on the dial command line or fetched from the modem's memory. The operator may

also initiate the call by using the handset, and then manually turn on the modem to dial mode. In the following, a call is being made to telephone number 86 77 99 99 (character format 7,E,1).

2.1.1 Auto Dial, Number is Entered.

The call is made by entering the following to the modem

```
AT D 86 77 99 99 <CR>
```

The modem makes the call. When the connection is established, the modem answers

```
CONNECT 2400
```

The data communication can now begin. The reply depends on the data rate selected.

It is recommended to monitor the dialling process by listening to the loudspeaker. If the connection is not established there is a possibility to locate the possible cause of the error.

First the modem waits for a dialtone, then it makes the call to the phone number entered. If the modem does not receive a dialtone, the following result code is displayed

NO DIALTONE

As the modem operates as a CCITT modem (V.21, V.23, V.22, V.22bis, V.32, V.32 bis), it will transmit an id/calling tone at intervals of 2 seconds after the call is completed, until another modem answers.

When the call has been completed, the modem waits for an answer tone (2100 Hz) from the remote modem. When the answer tone is detected, the two modems decide at which rate they can communicate, and then the connection is established.

If the modem does not detect an answer tone, or if the two modems cannot agree upon a data rate, the following result code is displayed after the maximum time for the call (45 seconds)

NO CARRIER

If the remote modem is busy, the modem displays the result code

BUSY

If the connection is established, the modem displays the following result code

```
CARRIER 14400  
PROTOCOL: LAP-M  
COMPRESSION: V.42bis  
CONNECT 38400
```

The value after CARRIER indicates the data rate of the established connection. This can either be 75/1200, 1200/75, 600, 1200, 2400, 4800, 9600, 12000 or 14400 bps.

When dialling, the LASAT modem is by default configured to give as much information as possible about the reason, if a connection is not established. This implies that the LASAT modem must recognize the tones from the telephone network (dialtone, busy tone, etc.). If it is preferred that the LASAT modem is to make the call in another way, see the command summary under the X command passage in chapter 3.

2.1.2 Auto Dialling, Pulse or DTMF.

As standard the modem is configured to use tone dialling (DTMF). In some cases it is necessary to make the call using pulse dialling. The modem can be adjusted to pulse dial before the call is made or during the call.

```
AT P <CR>
```

adjusts the modem to pulse dial while dialling.

The modem can be switched back to tone dialling by entering the following

AT T <CR>

The modem answers both these commands by

OK

Note:

This command is not supported in all countries.

2.1.3 Auto Dialling, through PABX, Number is Entered.

The modem can be connected to local lines on a PABX (switch board), in which case it is necessary to get an outside line via the switch board before a call can be completed. Usually, the outside line is acquired by activating a key on the handset, after which a dialtone from the exchange is heard. The key on pushbutton telephones could be '0', '1', '9' or 'R'.

If the '0'-key is used, the modem is able to complete the call by dialling 0, wait for a new dialtone, and then dial the telephone number. When dialling number 86 77 99 99 enter

AT D 0W 86 77 99 99 <CR>

after which the modem establishes the data connection to the remote modem.

If the 'R'-key (flash) is activated in order to establish an outside line, the modem is performing the call to telephone number +45 86 77 99 99 by the following command

AT DPIWT 86 77 99 99 <CR>

Note:

On some old models of PABXs using pulse dial it is impossible to use the above-mentioned methods. Here, it is necessary to get an outside line manually via the telephone, after which the modem is able to perform the rest of the call.

2.1.4 Auto Dialling, Using a Stored Number.

In order to make a call to a telephone number stored in the memory, it is necessary to start by saving the number. The LASAT modem is capable of storing 10 telephone numbers (0-9). If the number 86 77 99 99 is to be stored in '0', enter

AT &Z0= 86 77 99 99 <CR>

Up to 20 characters per telephone number can be stored in the memory of the modem, i.e. all the characters used for controlling the auto dial function.

Now the modem can make a call to the number stored by entering

AT DS=0 <CR>

When the data connection has been established the modem replies

CARRIER 14400
PROTOCOL: LAP-M
COMPRESSION: V.42bis
CONNECT 38400

The answer is dependent on the communication rate.

2.1.5 Manual Dialling.

The call is made on a telephone which is installed in parallel with the modem. This means that the telephone is connected to the PHONE plug on the modem. When the call has been made, the remote modem replies. The reply can be identified as a continuous tone (answering tone 2100Hz). Connection to the remote modem is done by commands from the computer.

Enter the following when the answering tone is heard

AT X1 D <CR>

Now the modem assumes control of the telephone line and the telephone is disconnected. The modem establishes a connection and gives the result code

CARRIER 14400
PROTOCOL: LAP-M
COMPRESSION: V.42bis
CONNECT 38400

Note:

When calling a V.32 or V.32bis modem it can be difficult to establish connection manually, as the timing as to when commands are made is very critical.

2.2 Disconnecting an Asynchronous Connection.

There are three ways of disconnecting an asynchronous connection:

1. The modem can be instructed to disconnect the connection.
2. The remote modem can disconnect the connection.
3. The connection can be disconnected by the computer.

In order to disconnect the data connection, the modem must be brought from data mode to command mode. From here it is possible to disconnect the connection. To enter command mode type:

+++

The keyboard must not be touched one second before and after the three pluses, and the <CR> key must not be activated.
The modem answers

OK

The connection can now be disconnected by entering

AT H <CR>

the modem then answers

NO CARRIER

The remote modem can disconnect the connection when the data base is left. The LASAT modem detects that the origin modem has disconnected the connection and answers

NO CARRIER

The connection has now been disconnected, and the modem is ready for other purposes. If the computer is disconnected or if the computer is switched off the modem disconnects the data connection depending on the &D command setting (DTR ignored). This way the modem will not maintain a telephone connection, if no computer/terminal is attached to it unnecessarily.

It is possible to let the LASAT modem inform the modem with which it is communicating that it is about to disconnect the connection. To use this feature it has to be enabled on both modems. As a standard this function is not available but it can be turned on by entering the following command when dialling

AT Y1 D 86 77 99 99 <CR>

The function is switched off by the command

AT Y <CR>

2.3 Answering Function.

When the telephone receives an incoming call, the modem transmits a result code, indicating that the telephone has rung

RING

If the telephone and the modem are connected in parallel, and the call is an ordinary telephone conversation, the call is to be answered in the usual way. The modem can also operate as an answer modem, and it is

possible to choose between auto and manual answering function.

2.3.1 Auto Answering Function.

Before the modem is capable of operating as an answer modem, auto answer has to be enabled. The number of incoming RINGs, before the modem will answer the call, may be adjusted, so that it is possible to answer the telephone before the modem answers. If the modem is to answer the call after the first ring, enter

```
AT S0=1 <CR>
```

If a longer period of time is required, before the modem is to answer, 1 is replaced by the number of rings required.

The LASAT modem connects to the telephone line and starts an answering sequence. When the origin modem has recognized the answering sequence, the connection is established, and the modem answers

```
CARRIER 14400  
PROTOCOL: LAP-M  
COMPRESSION: V.42bis  
CONNECT 38400
```

2.3.2 Manual Answer.

At the end of a conversation, or if the modem is not adjusted to auto answer mode, a manually established connection can be used.

The data connection can be established by the command

```
AT A <CR>
```

The LASAT modem answers the call, and when the connection has been established, the following result code will appear

```
CARRIER 14400  
PROTOCOL: LAP-M  
COMPRESSION: V.42bis  
CONNECT 38400
```

The result code is dependent on the data rate.

2.4 Description of Constant Rate and Flow Control.

The modem comprises a facility which makes it possible to maintain a constant terminal rate, without regard to the communication rate achieved on the telephone line. This is an advantage if the modem is used in connection with several different data bases connected to modems with different maximum rates. It is possible to let the autobaud function set the terminal rate and let the modem determine the rate on the telephone line. In order not to lose data when using a terminal rate of f.ex. 9600 and a telephone line rate of 2400, it is necessary to use flow control between modem and computer.

This can be done in two ways, hardware based on RTS-105/CTS-106 or software based at XON/XOFF. Hardware flow control is obtained by entering

```
AT &K3 <CR>
```

To obtain software flow control, enter

```
AT &K4 <CR>
```

Hardware flow control is default.

2.5 Configuration of the Modem.

The modem uses the active configuration during the operation. Besides changing the active configuration by AT commands it is possible to retrieve factory/user configuration and factory configuration. Furthermore, the active configuration can be stored as factory/user configuration 1 or 2. To retrieve and to store the configuration the

following commands are available.

Retrieve factory configuration 0

AT &F <CR>

Retrieve standard configuration 0

AT Z <CR>

Store active configuration as standard configuration 0

AT &W <CR>

Retrieve factory/user configuration 0 when the modem is turned on

AT &Y <CR>

The active configuration is stored in the S-registers of the modem. It is possible to obtain the value of these registers, and by doing so the configuration can be read. The values can be read by the command

AT &V <CR>

For factory configuration 0 the answer is

```
ACTIVE PROFILE:
B0 E1 L1 M1 N1 O0 T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0 &Y0
S00:002 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:030 S08:002 S09:006
S10:014 S11:25 5 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S46:138
S48:007 S95:000
```

```
STORED PROFILE 0:
B0 E1 L1 M1 N1 O0 T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0
S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:105 S41:003 S46:138 S95:000
```

```
STORED PROFILE 1:
B0 E1 L1 M1 N1 O0 T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0
S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:105 S41:003 S46:138 S95:000
```

```
TELEPHONE NUMBERS:
0 =
2 =
```

```
1 =
3 =
```

For further explanation see S-registers in the Appendix.

The configuration can also be read by the command

AT \S <CR>

which gives a summary of the active configuration of the modem.

It is also possible to see the 20 telephone numbers stored in the modem by the following command

AT \F <CR>

2.5.1 Command and Result Code Form.

When the factory configuration is used as the active configuration of the modem, all the characters given in the command mode are returned to the computer. Besides, a result code in the form of a text is given when a command has been completed. It is possible to alter the result codes to be numeric, to disable the result codes completely, and to switch off the echo of characters.

Echo of characters is switched off by the command

AT E <CR>

and may be turned on again by

AT E1 <CR>

If for example the characters in a command are seen double on the monitor, it is due to the fact that both the computer and the modem are transmitting characters to the monitor. In order to see the characters individually, the echo must be switched off in the computer or in the modem. Regarding the modem it is done as described above.

If the result codes are to be numeric, use the command

AT V <CR>

If the result codes are to be text use the command

AT V1 <CR>

The result codes can be disabled by the command

AT Q1 <CR>

and they can be enabled again by the command

AT Q <CR>

If for example characters from the modem are unwanted when in the command position, the following command can be used

AT E Q1 <CR>

The above mentioned commands are primarily used in connection with programmes, which control the operation (dial and answer) of the modem.

2.5.2. Internal Loudspeaker.

The monitoring function of the internal loudspeaker can be controlled by commands entered in the LASAT modem. It is possible to control the level at three steps, and also to control during which periods of the call and the data transmission, the loudspeaker is turned on.

Typically, the loudspeaker is turned on during a call, but can be switched off by the command

AT M <CR>

If it is to be switched on again, use the command

AT M1 <CR>

The volume of the loudspeaker can be set at three levels. Usually it is set at medium.

The volume can be set at low level by the command

AT L1 <CR>

The volume is set at high level by the command

AT L3 <CR>

For further information of the monitoring function see chapter 4 (L and M commands).

2.5.3 Identification of the Modem.

It is possible to ask the modem for an identification, the maximum data rate, which type of LASAT modem it is and the software version used.

To get rate and model enter

AT I <CR>

The firmware version is obtained by entering

AT I3 <CR>

After this the modem returns a string containing the version number.

2.6 Special Facilities.

Besides using the modem as a modem, the command set opens up the possibility of using the modem for different kinds of telephone calls, for example calls to the beeper service and abbreviated dialling in connection with market analyses and the like.

2.6.1 Number Sending Facility.

The LASAT modem can be used for making calls to a telephone number, after which the line can be returned to the telephone. To make a call enter the following

AT D <telephone number> <CR>

Now, the modem makes the call, and when the loudspeaker indicates that the auto dialling has been completed, the handset is picked up. A key on the computer is activated, and when the dialling has been completed, the line is returned to the telephone.

In order to make the most of the auto dialling facility it requires a programme which is capable of transmitting a number from a database. Most of the communication programmes render the possibility of establishing a "phone book".

The modem can also be used for DTMF signalling, for measuring stations or the like, which can be controlled by the telephone line.

2.7 Establishing a Synchronous Connection.

In order to use the modem for synchronous operation it is necessary to change the standard configuration. This is done by the AT command set from an asynchronous terminal. The synchronous connection can be established in three ways.

1. From an asynchronous data mode, the LASAT modem can make a call and establish a connection.

2. It is also possible to establish a connection by means of the serial control signal DTR.

3. The V.25bis command interpreter renders the possibility of establishing a synchronous connection based on a terminal/computer which is able to issue dial commands in the synchronous V.25bis formats.

2.7.1 Manual Call, Connection controlled by DTR, Synchronous Connection.

This function is used from a terminal or computer, where DTR is set ON or can be forced ON, when the connection is to be established. The modem is set to synchronous operation with the following command from an asynchronous terminal

AT &F S26=10 &Q3 E0 Q1 &D3 &W <CR>

No answer code is received to this command, as these have been switched off.

The modem is transferred from the asynchronous interface (RS232C/V.24) to the synchronous serial interface.

The call is made via a telephone connected to the modem. During the period from the modem is turned on and until the call has been completed, DTR must be kept OFF. When the call has been completed, the remote modem answers with a continuous tone (answer tone 2100Hz), and when it is heard DTR is set ON. The modem takes over the telephone line, and the receiver can be hung up.

2.7.2 Auto Dialling, Controlled of DTR, Synchronous Connection.

This function is used when the modem is to make the call automatically to a synchronous modem. This demands complete control of DTR. In order for the modem to be able to make an auto call, make sure that the telephone number has been stored

AT &Z0= <telephone number> <CR>

<telephone number> is the telephone number of the modem which should be established to (parameters for <telephone number> which can be seen under the D command, see chapter 3). The modem can now be set to synchronous operation

AT &F S26=10 &Q2 E0 Q1 &D3 &W <CR>

Now, the standard configuration of the modem is synchronous operation with auto dialling. No answer code is received to this command, as these are switched off with the first command.

DTR must be set OFF, if a modem connection is unwanted. When the modem connection is to be established, DTR is set ON, after which the modem makes an auto call to the number. The connection is established when the DCD indicator is ON.

2.7.3 Auto Call, Number is Entered, Synchronous Connection.

This function is used when the terminal/computer used is able to change between asynchronous and synchronous operation. In this way it is possible to set the modem at synchronous operation and perform the call by means of the command interpreter. The configuration of the modem is performed by entering

```
AT S26=10 &Q1 <CR>
```

from asynchronous mode.

The LASAT modem is now ready to receive a telephone number to perform auto call and synchronous connection to a remote modem. The call is performed by entering the following

```
AT D <telephone number> <CR>
```

and then the modem performs the call to the telephone number <tel. No.>. When the modem connection is established, the LASAT modem operates like a synchronous modem. When the connection has been established it is possible to change from an asynchronous to a synchronous connection either by moving the serial cable or by making the computer change the serial port from asynchronous to synchronous data signalling.

2.7.4 Disconnect Synchronous Connection.

There are two ways of disconnecting a synchronous data signalling

connection:

1.
The remote modem may disconnect the connection. By doing so the modem disconnects the connection.
2.
The serial signal DTR may be set OFF by means of which the LASAT modem disconnects the connection to the remote modem.

2.7.5 Mixed Synchronous and Asynchronous Operation.

In some situations the same modem is to be used for synchronous as well as asynchronous operation. When this is the case the modem is set to synchronous operation and this is stored as standard/user configuration 1, and the asynchronous configuration can be stored as standard/user configuration 2.

2.7.6 Auto Answer, Synchronous Operation.

To make the modem operate as a synchronous modem with auto answer the following command is entered from an asynchronous terminal

```
AT &F S26=10 S0=1 &Q1 E0 Q1 &D3 &W <CR>
```

Then the modem is connected to the synchronous computer/terminal. When it receives a call it will perform an auto answer after the first ring.

2.8 Establishing an Error Correcting/Data Compressing Connection.

As standard the LASAT modem is set to operate as a V.42 modem. This means that the V.42 error correcting negotiation part and the rate converting are on.

It should be emphasized that consideration is taken to flow control

throughout the system, if there is a difference between line and terminal rate. Between the modems the error correcting procedure handles the control. Between modem/terminal software or hardware flow control has to be chosen. In the following several examples will be described showing how 3 different error correcting/data compressing procedures can be used together with flow control.

The function of each command and the most suitable surroundings are amplified in order to facilitate the assimilation to other surroundings.

2.8.1 V.42 Answer Modem with Negotiation and Hardware Flow Control.

This configuration can be used where the modem must be able to receive calls from all types of modems (V.22, V.22bis, V.32, V.32bis with or without error correction/data compression)

`AT \N3 %C1 <CR>`

The terminal rate on the serial interface is set at 9600, 57600, 38400 bps. This requires the use of flow control, and this is set to RTS/CTS flow control (&K3).

The minimum block size is chosen (64 bytes \A0). It can be increased if this does not cause problems.

To reduce the line switching time for non V.42 modems a dial-up modem can interrupt the negotiation phase of the V.42 answer modem by transmitting a <CR>, as soon as it has established the connection (\C2, %A013).

The total AT command string will be as follows:

`AT &F \N3 %C1 &K3 \A0 S0=1 <CR>`

The LASAT modem now has a factory/user configuration so that it responds to calls and establishes the quickest and safest connection possible with the calling modem.

When a call is received the two modems will establish a modem connection and then they will try to establish an error correcting connection. If an error correcting connection is established successfully the modem responds with

CARRIER 14400
 PROTOCOL: LAP-M
 COMPRESSION: V.42bis
 CONNECT 38400

2.8.2 V.42 Dial-up Modem with Negotiation and Hardware Flow Control.

This configuration is used when calling from the LASAT modem to a modem which uses a V.42 error correcting protocol

`AT \N3%C1 <CR>`

The configuration can also be used if the configuration of the modem called is not known in advance, as the modems themselves reach the optimal communication (V.42 with compulsory LAP-M, V.42 with compulsory MNP or a "Normal" connection if everything else fails).

Like for the answer modem a fixed speed and data compression is used.

When error correction occurs, data, which have been damaged during transmission, are re-transmitted, so that only the correct data are delivered to the terminal. This technique ensures that data are transmitted 100% error free. If re-transmissions are unnecessary and the modem uses V.42 as error correction it is possible to increase the character flow through the modem by up to 120% of the data signalling rate. It is possible because data from the terminal to the modem will be transferred asynchronously (10 bps) whereas data between the modems can be transferred synchronously (8 bps).

Data compression gives the possibility to increase the efficient number of characters sent and establishes the quickest and safest connection. When a call is performed the two modems will establish a modem connection and then they will try to establish an error correcting

connection. If establishment of an error correcting connection is successful the modem answers

CARRIER 14400
PROTOCOL: LAP-M
COMPRESSION: V.42bis
CONNECT 38400

2.8.3 V.42 Modem with Compulsory MNP or LAP-M.

If the error correction of the remote modem is known there is a possibility to configure the LASAT modem so that the V.42 negotiation phase can be left out and the connection can then be made quicker.

If the remote modem is a MNP modem and an error correcting connection must be established \N5 and %C1 are used.

If the remote modem is a V.42 modem, which is able to use LAP-M, the V.42 negotiation phase can be left out by entering \N4 and %C1.

As in earlier cases also here RTS/CTS or XON/XOFF flow control should be chosen, as otherwise data between the terminal and the modem can disappear.

2.8.4 V.42 and Test.

If errors occur during the transmission the error correcting procedure will make sure that data will arrive correctly.

If the error rate becomes so big that the error correcting procedure has to be interrupted it could be an advantage to test the remote and the local modem together with the line in between as described in chapter 4.

Before performing the tests described in chapter 4, see chapter 5.3.

2.9 V.25bis Command Interpreter.

The LASAT modem contains a V.25bis command interpreter, which makes calls and answers possible. A configuration of the modem is normally performed through the AT-command interpreter before V.25bis is selected.

The V.25bis command interpreter is selected with following AT command

ATS80=32Z <CR>

When this command is given the answer

OK

is received indicating that the V.25bis interpreter is active. Hereafter the modem will only use V.25bis commands and answers.

The V.25bis command must be entered with capital letters. The modem uses 10-bits characters for the transmission.

If at a certain time another configuration of the modem is desirable, or if the modem should again operate as an AT modem, the following command is given to the V.25bis command interpreter

CNLS80=0Z <CR>

and the reply is

OK

as an indication that the AT command interpreter is active again.

2.9.1 Calls with V.25bis.

In order for the modem to make a call the following command is used

CRN <number> <CR>

where <number> is a telephone number as described under the D command in chapter 4. In the number the following punctuation marks are accepted:

"<" -Pause in call for 2 seconds. Corresponds to "," in the ATD command.

":" -Wait for new dialling tone. Corresponds to "W" in ATD.

When the call has been completed the modem replies

CNX 14400

A 14400 bps data connection is established. If the call is unsuccessful a call failure answer will be given. For further description please see answer codes in the Appendix.

2.9.2 Answer with V.25bis.

When the modem receives a call the ring indicator (CCITT V.24-125) goes ON during the call. At the same time the modem transmits the following message

INC

When the modem is set to auto answer a response will be given after two rings.

Auto answer is set with the command Connect Incoming Call

CIC <CR>

and the reply is

VAL

Then the modem will automatically respond to an incoming ring when DTR (CCITT V.24 - 108/2) is ON.

If a disconnection of the auto answer is desirable again, the command Disconnect Incoming Call is used

DIC <CR>

and the reply is

VAL

2.9.3 Disconnection of Connection in V.25bis.

A modem connection is disconnected when DTR (CCITT V.24-108/2) is set OFF or by loss of carrier.

2.10 Remote Config.

The LASAT 144-series modems have a possibility to perform remote config in two ways. Both methods will be described in the following paragraphs, with a small example in each paragraph.

Remote config is a facility which makes it possible to remote configure a modem which cannot be reached physically.

Please note that not all normal commands can be used and that some commands may leave the remote modem useless afterwards. If this is the case the modem must be configured in the usual way.

2.10.1 Remote Config between two LASAT 144-series Modems.

Between two LASAT 144-series modems it is possible to perform a special remote config, which can only be activated during a MNP error correcting connection. This remote config can only be activated between two LASAT 144-series modems.

LASAT 144-series modems

In order to activate remote config, bit 6 in S-register 80 must be set to 1:

AT S80=65

When the MNP connection between the two LASAT 144-series modems has been carried out, remote config is activated with the command:

AT *R

Example:

Remote config between two LASAT 144-series modems.

Configuration of the remote modem:

Terminal: ATS80=64S0=1&W

Modem: OK

Terminal: ATZ

Modem: OK

Configuration of the local modem:

Terminal: AT&FN5
Set the modem for MNP

Modem: OK

Terminal: ATD12 34 56 78
Make MNP call

Modem: CARRIER 14400
PROTOCOL: ALT
COMPRESSION: V.42BIS
CONNECT 9600

2. Functional Description.

Terminal: +++
Go in command mode

Modem: OK

Terminal: AT *R
Activate remote config

Modem: REMOTE PASSWORD:

Terminal: QWERTY
Type password. QWERTY default (case sensitive).

Modem: PROTOCOL: ALT
COMPRESSION: V.42BIS
CONNECT 9600
!AT
Prompt from remote modem.

Remote config can now be carried out on the remote modem. Please note that not all commands can be given, and that some commands may disconnect the connection.

Terminal: *E
Leave remote config on remote modem.

Modem: OK

Terminal: ATO
Leave command mode on local modem.

Modem: PROTOCOL: ALT
COMPRESSION: V.42BIS
CONNECT 9600
Connect message after return to data mode.

Change of remote config password happens with the command

AT *C

Note:

Please note that if the password is forgotten, it is not possible to use this function anymore. The default password can be re-inserted by the technical staff of LASAT, but it requires that the modem is sent in for service.

Also see the comments for the commands

AT *E, AT *R

in chapter 3.1.4

2.10.2 Remote Config between a LASAT 144-series Modem and another Hayes Compatible Modem.

If the local modem is not a LASAT 144-series modem, and can therefore not use the method described in chapter 2.10.1, it is still possible to perform remote config on a LASAT 144-series modem.

This is done by transmitting a remote escape sequence to the LASAT 144-series modem. The remote escape sequence is default "*****".

Example:

Remote config between a LASAT 144-series modem and another hayes compatible modem.

Configuration of the remote modem (the LASAT 144-series modem):

Terminal: ATS202=42S0=1S80=64&WZ
 Configure the modem for remote, config, auto
 answer and "*" as remote escape character.

Modem: OK

Configuration of local modem (a non-LASAT 144-series modem):

Terminal: Configure the modem for the required type of
 connection.

Terminal: Make a call to the LASAT 144-series modem.

Modem: Wait for connect message.

Terminal: ****
 Enter remote config mode.

Modem: ONLINE REMOTE ACCESS
 REMOTE PASSWORD:
 Remote config message from the LASAT 144-series
 modem.

Terminal: QWERTY
 Type password. QWERTY is default (case sen-
 sitive).

Modem: OK
 >
 Prompt from the remote LASAT 144-series modem.

Remote config can now be carried out on the remote modem. Please note that not all command can be given and that some commands can disconnect the connection.

Terminal: AT *X (AT *E)
 Leave remote config.

Modem: OK
 CONNECT
 Leave command mode and enter data mode.

Change of remote config password takes place with the command

AT *C

Note:

Please note that if the password is forgotten, it is not possible to use this function anymore. The default password can be re-inserted by the technical staff of LASAT, but it requires that the modem is sent in for service.

2.11 Dial Back.

The LASAT 144-series modems have a possibility to perform dial back. This means that before the user is connected to DTE on the remote modem a password must be given. If a telephone number is attached to the given password, the phone call will be returned if the user is not connected to DTE.

2.11.1 Dial Back with Return Call.

In order to make a LASAT 144-series modem perform dial back, at least one password and return telephone number must be saved with the command:

AT *Pn:<password>:<telephone number>

It is possible to store 20 passwords/telephone numbers. The password has to be between 6 and 12 characters. The telephone number can be maximum 40 characters.

In order to activate the dial back function bit 7 in S-register 80 has to be set to 1

AT S80=129

Example:

Dial back to telephone number 12 34 56 78 must be made from a LASAT 144-series modem.

Configuration of the LASAT 144-series modem:

Terminal: AT S0=1 S80=129 &W Z
Activate the dial back function as well as auto answer.

Modem: OK

2. Functional Description.

Terminal: AT *P0:LASATLASAT:12345678
Store telephone number and password

Modem: OK

It is now possible to make a call to the LASAT 144-series modem.

Terminal: AT D87 65 43 21
Make a call to the LASAT 144-series modem.

Modem: CARRIER 14400
PROTOCOL: LAP-M
COMPRESSION: V.42BIS
CONNECT 9600
A possible connect message (if another LASAT 144-series modem is being used).

Modem: ENTER PASSWORD:

Terminal: LASATLASAT
Enter password

Modem: NO CARRIER
The modem connection is disconnected and the LASAT 144-series modem returns the call.

Modem: RING

Terminal: ata

Modem: CARRIER 14400
PROTOCOL: LAP-M
COMPRESSION: V.42BIS
CONNECT 9600

2.11.2 Dial Back without Return Call.

In paragraph 2.11.1 it was described how a LASAT 144-series modem is set to perform dial back. If this is not necessary the telephone number

must be left out as shown below:

AT *Pn;<password>

When a call is made to the LASAT 144-series modem the user will be prompted for a password. If the password is correct, the user is connected to the DTE without dial back.

3. Command Sets.

3.1 AT Command Guidelines.

The basic AT commands used to control modem operation are defined in this section. These commands are summarized in Appendix A.

3.1.1 AT Commands, DTE Adaption.

Under AT operation, the serial interfaced modem performs an autobaud/autoparity/autolength function on each AT header entered. The autolength/autoparity facility can detect 7- or 8-bit characters of even, odd, or no parity with one stop bit.

3.1.2 AT Command Format.

Under the AT command set (with the exception of the A/ command), each command line sent by the DTE must begin with the character sequence AT and must be terminated by a carriage return. Commands entered in upper case or lower case are accepted, but both the A and T must be of the same case. The command line interpretation begins upon receipt of the carriage return character.

The modem supports the editing of command lines by recognizing a backspace character. When modem echo is enabled, the modem responds to receipt of a backspace or delete by echoing a backspace character, a space character, and another backspace. The hex value to be used for the backspace character is programmable through register S5. Values equal to 0 or greater than 127, or the value which corresponds to the carriage return character, cannot be used for the backspace character. This editing is not applicable to the AT header of a command. A command line may be aborted at any time by entering <ctrl-x> (18h).

The AT sequence may be followed by any number of commands in sequence, except for commands such as Z, D, or A. Commands following commands Z, D, or A on the same command line will be

ignored. The maximum number of characters on any command line is 253.3 (including "A" and "T"). If a syntax error is found anywhere in a command line command, the remainder of the line will be ignored and the ERROR result code will be returned.

Most commands entered with parameters out of range will not be accepted and the ERROR response will be returned to the DTE.

Commands will only be accepted by the modem once the previous command has been fully executed, which is normally indicated by the return of an appropriate result code. Execution of commands D and A, either as a result of a direct command or a re-execute command, will be aborted if another character is entered before completion of the handshake.

3.1.3 Escape Code Sequence.

When the modem has established a connection and has entered on-line data mode, it is possible to break into the data transmission in order to issue further commands to the modem in an on-line command mode. This is achieved by the DTE sending to the modem a sequence of three ASCII characters specified by register S2. The default character is '+'. The timing of the three characters must comply with specific time constraints. There is a guard time before the first character (the pre-sequence time), a guard time following the third character (the post-sequence time), and a guard time-out between the first and second characters and between the second and third characters (the inter-character time). These times are controlled by the value recorded in register S12.

3.1.4 AT Command Set.

The modem will respond to the commands detailed below. Parameters applicable to each command are listed with the command description. The defaults shown for each configuration command are those used in the factory profile 0.

Re-execute command.

A/

The modem behaves as though the last command line had been re-sent by the DTE. "A/" will repeat all the commands in the command buffer. The principle application of this command is to place another call (using the Dial command) that failed to connect due to a busy line, no answer, or a wrong number. This command must appear alone on a command line and must be terminated by the "/" character.

Note:

This command should not be terminated by a carriage return.

Write to selected s-register.

AT=x

This command writes the value x to the currently selected S-register. An S-register can be selected by using the ATSn command. All of the S-registers will return the OK response if x is a number.

Note:

Some registers may not be written due to country specific PTT limitations.

Read selected s-register.

AT?

This command reads and displays the selected S-register. An S-register can be selected by using the ATSn command.

Answer.

AT A

The modem will go off-hook and attempt to answer an incoming call if correct conditions are met. Upon successful completion of answer handshake, the modem will go on-line in answer mode.

This command may be affected by the state of Line Current Sense, if enabled. (Most countries do not require Line Current Sense.) Operation is also dependent upon +FCLASS command and country-specific requirements.

If +FCLASS=0 is selected, the modem will enter the connect state after exchanging carrier with the remote modem. If no carrier is detected within a period specified in register S7, the modem hangs up. Any character entered during the connect sequence will abort the connection attempt.

If +FCLASS=1 or 2 is selected, the modem will go off-hook in V.21 answer mode. It will generate the V.21 2100 Hz answer tone for 3 ± 0.5 seconds and, following a delay of 70 ms, will proceed as if the +FTH=3 command were issued. At any stage up to (but excluding) the +FTH=3 command state, any character will abort the communication. (See the description of the +FTH command for details.)

CCITT or Bell.

When the modem is configured to allow either option, the modem will select Bell or CCITT modulation for a line speed connection of 300 or 1200 bps according to the parameter supplied. Any other line speed will use a CCITT modulation standard. The parameter value, if valid, is written to S27 bit 6. (Also, see ATFn command.)

AT B0 Selects CCITT operation at 300 or 1200 bps during Call Establishment and a subsequent connection (default).

AT B1 Selects BELL operation at 300 or 1200 bps during Call Establishment and a subsequent connection.

Carrier control.

AT CI This command is included for compatibility only, and has no effect other than returning a result code.

Dial.

AT D This command directs the modem to go on-line, dial according to the

string entered and attempt to establish a connection. If no dial string is supplied, the modem will go on-line and attempt the handshake in originate mode. The action of going off-hook is affected by the status of the Line Current Sense input, if line current sensing is enabled, and by the blacklist and delayed list.

If +FCLASS=0 is selected, the modem will behave as a data modem and will attempt to connect to another data modem. The modem will have up to the period of time specified by register S6 or S7 to wait for carrier and complete the handshake. If this time expires before the modem can complete the handshake, the modem will go on-hook with the NO CARRIER response. This command will be aborted upon receipt of any DTE character before completion of the handshake.

If +FCLASS=1 or 2 is selected, the modem will behave as a facsimile modem and attempt to connect to a facsimile machine (or modem) by entering the HDLC V.21 channel 2 receive state (as if +FRH=3 had been issued). This command will be aborted upon receipt of any DTE character if the modem has not finished dialling. In this case, the modem will go on-hook and return to command mode after displaying the NO CARRIER message. If the modem has finished dialling, it proceeds as if the +FRH=3 command has been issued. (Refer to the +FRH command to determine how the modem behaves following this stage).

Dial modifiers.

The valid dial string parameters are described below. Punctuation characters may be used for clarity, with parentheses, hyphen, and spaces being ignored.

0-9

Tone and pulse dial digits 0 to 9.

*

The 'star' digit (tone dialling only).

#

The 'gate' digit (tone dialling only).

A-D

DTMF digits A, B, C, and D.

Note:

Some countries may prohibit sending of these digits during dialling.

J

Perform MNP 10 link negotiation at the highest supported speed (for this call only). (See *H.)

K

Enable power level adjustment during MNP 10 link negotiation (for this call only). (See)Mn.)

L

Re-dial last number: the modem will re-dial the last valid telephone number. The L must be immediately after the D with all the following characters ignored.

P

Select pulse dialling: pulse dial the numbers that follow until a "T" is encountered. Affects current and subsequent dialling.

Note:

Some countries prevent changing dialling modes after the first digit is dialled.

T

Select tone dialling: tone dial the numbers that follow until a "P" is encountered. Affects current and subsequent dialling.

Note:

Some countries prevent changing dialling modes after the first digit is dialled.

R

This command will be accepted, but not acted on.

S=n

Dial the number stored in the directory (n = 0 to 19). (See &Z.)

!

Flash: the modem will go on-hook for a time defined by the value of S29. Country requirements may limit the time imposed.

W

Wait for dial tone: the modem will wait for dial tone before dialling the digits following "W". If no dial tone is detected within the time specified by S6, the modem will abort the rest of the sequence, return on-hook, and generate an error message.

@

Wait for silence: the modem will wait for at least 5 seconds of silence in the call progress frequency band before continuing with the next dial string parameter. If the modem does not detect these 5 seconds of silence before the expiration of the call abort timer (S7), the modem will terminate the call attempt with a NO ANSWER message. If busy detection is enabled, the modem may terminate the call with the BUSY result code. If answer tone arrives during execution of this parameter, the modem handshakes.

Dial pause: the modem will pause for a time specified by S8 before dialling the digits following ",".

Note:

This modifier may not be used in Sweden.

; Return to command state. Added to the end of a dial string, this causes the modem to return to the command state after it processes the portion of the dial string preceding the ";". This allows the user to issue additional AT commands while remaining off-hook. The additional AT commands may be placed in the original command line following the ";", and/or may be entered on subsequent command lines. The modem will enter call progress only after an additional dial command is issued without the ";" terminator. Use "H" to abort the dial in progress, and go back on-hook.

^
Disable calling tone: applicable to current dial attempt only.

()
Ignored: may be used to format the dial string.

-
Ignored: may be used to format the dial string.

<space>
Ignored: may be used to format the dial string.

<i>
Invalid character: will be ignored.

>
Ignored: not implemented.

Command echo.

The modem enables or disables the echo of characters to the DTE according to the parameter supplied. The parameter value, if valid, is written to S14 bit 1.

AT E0 Disables command echo.

AT E1 Enables command echo (default).

Select line modulation.

This command selects the line modulation according to the parameter supplied. The line modulation is fixed unless automode is selected. This command interacts with the S37 and the N command. The parameter value, if valid, is written to S31 bit 1. To select line modulation, it is recommended that either the F command, or a combination of the S37 and the N command, be used, but not both.

AT F0 Selects auto-detect mode. Sets N1 and sets S31 bit 1. In this mode, the modem configures for automode operation. All connect speeds

supported by the modem are possible according to the remote modem's preference. The contents of S37 are ignored as is the sensed DTE speed.

AT F1 Selects V.21 or Bell 103 according to the B setting as the only acceptable line speed resulting in a subsequent connection. Sets N0, sets S37 to 1, and clears S31 bit 1.
This command is equivalent to the command string: ATN0S37=1.

AT F2 Not supported.

AT F3 Selects V.23 as the only acceptable line modulation for a subsequent connection. Originator is at 75 bps and answerer is at 1200 bps. Sets N0, sets S37 to 7, and clears S31 bit 1.
This command is equivalent to the command string: ATN0S37=7.

AT F4 Selects V.22 1200 or Bell 212A according to the B command setting as the only acceptable line speed for a subsequent connection. Sets N0, sets S37 to 5, and clears S31 bit 1.
This command is equivalent to the command string: ATN0S37=5.

AT F5 Selects V.22 bis as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 6, and clears S31 bit 1.
This command is equivalent to the command string: ATN0S37=6.

AT F6 Select V.32 bis 4800 or V.32 4800 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 8, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=8.

AT F7 Selects V.32 bis 7200 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 12, and clears S31 bit 1.
This command is equivalent to the command string:
ATN0S37=12.

This setting also allows connection at the proprietary 7200 V.32 speed standard.

AT F8 Selects V.32 bis 9600 or V.32 9600 as the only acceptable line modulations for a subsequent connection. Sets N0, sets S37 to 9, and clears S31 bit 1.
This command is equivalent to the command string: ATN0S37=9.

AT F9 Selects V.32 bis 12000 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 10, and clears S31 bit 1. This command is equivalent to the command string:

ATN0S37=10.

This setting also allows connection at the proprietary 12000 V.32 speed standard.

AT F10 Selects V.32 bis 14400 as the only acceptable line modulation for a subsequent connection. Sets N0, sets S37 to 11, and clears S31 bit 1. This command is equivalent to the command string: ATN0S37=11.

Disconnect (Hang-Up).

This command initiates a hang up sequence.

AT H0 The modem will release the line if the modem is currently on-line, and will terminate any test (AT&T) that is in progress. Country specific, modulation specific, and error correction protocol specific (S38) processing is handled outside of the H0 command.

AT H1 If on-hook, the modem will go off-hook and enter command mode. The modem will return on-hook after a period of time determined by S7.

Note:

This command may not be available for some countries due to PTT restrictions.

Identification.

The modem reports to the DTE the requested result according to the command parameter.

AT I0 Reports product code.

AT I1 Reports pre-computed checksum from ROM.

AT I2 Computes checksum and compares it with value stored in ROM. Reports result as OK or ERROR.

AT I3 Reports firmware revision.

AT I4 Reports additional product identification.

AT I5 Reports Country Code parameter.

AT I6 Reports additional product identification.

Speaker volume.

The modem sets the speaker volume control according to the parameter supplied. The parameter value, if valid, is written to S22 bits 0 and 1.

AT L0 Off or low volume.

AT L1 Low volume (default).

AT L2 Medium volume.

AT L3 High volume.

Speaker control.

This command selects when the speaker will be on or off. The parameter value, if valid, is written to S22 bits 2 and 3.

AT M0 Speaker is always off.

AT M1 Speaker is on during call establishment, but off when receiving carrier (default).

AT M2 Speaker is always on.

AT M3 Speaker is off when receiving carrier and during dialling, but on during answering.

Automode enable.

This command enables or disables automode detection. The parameter value, if valid, is written to S31 bit 1.

AT N0 Automode detection is disabled. A subsequent handshake will be

conducted according to the contents of S37 or, if S37 is zero, according to the most recently sensed DTE speed.

AT N1 Automode detection is enabled. A subsequent handshake will be conducted according to the automode algorithm supported by the modem. This command is equivalent to F0 (default).

Return to on-line data mode.

This command determines how the modem will enter the on-line data mode. If the modem is in the on-line command mode, the enters the on-line data mode with or without a retrain. If the modem is in the off-line command mode (no connection), ERROR is reported.

AT O0 Enters on-line data mode without a retrain. Handling is determined by the Call Establishment task. Generally, if a connection exists, this command connects the DTE back to the remote modem after an escape (+++).

AT O1 Enters on-line data mode with a retrain before returning to on-line data mode.

Set pulse dial default.

AT P This command forces pulse dialling until the next T dial modifier or T command is received. Sets S14 bit 5.

As soon as a dial command is executed which explicitly specifies the dialling mode for that particular call (e.g., ATDT...), this command is overridden so that all future dialling will be tone dialled (see T command).

Note:

This command may not be permitted in some countries.

Quiet results codes control.

The command enables or disables the sending of result codes to the DTE according to the parameter supplied. The parameter value, if valid, is written to S14.

AT Q0 Enables result codes to the DTE (default).

AT Q1 Disables result codes to the DTE.

Read/write s-register.

The modem selects an S-register, performs an S-register read or write function, or reports the value of an S-register.

AT Sn Establishes S-register n as the default register.

AT Sn=v Sets S-register n to the value v.

AT Sn? Reports the value of S-register n.

The parameter n can be omitted, in which case S0 will be assumed. The S can be omitted in which case the last s-register accessed (default register) will be assumed.

For example:

ATS7 establishes S7 as the default register.

ATS38 establishes S38 as the default register.

AT=40 sets the contents of the default register to 40.

ATS=20 sets the contents of S0 to 20.

If the number "n" is beyond the range of the S-registers available, the modem will return the ERROR message. The value "v" is "MOD"ed with 256. If the result is outside the range permitted for a given S-register the values will still be stored, but functionally the lower and higher limits will be observed. Input and output are always in decimal format. Note that some S-registers are read-only.

In some cases, writing to the S register will appear to be accepted but the value will not actually be written.

Note:

Due to country restrictions, some commands will be accepted, but the value may be limited and replaced by a maximum or minimum value.

Set tone dial default.

- AT T** This command forces DTMF dialling until the next P dial modifier or P command is received. The modem will set an S register bit to indicate that all subsequent dialling should be conducted in tone mode. Note that the DP command will override this command. Clears S14 bit 5. This command may not be permitted in some countries (see P).

Result code form.

This command selects the sending of short-form or long-form result codes to the DTE. The parameter, if valid, is written to S14 bit 3.

- AT V0** Enables short-form (terse) result codes. Line feed is not issued before a short-form result code.
- AT V1** Enables long-form (verbose) result codes (default).

Error correction message control.

This command controls the format of CONNECT messages. The parameter value, if valid, is written to S31 bits 2 and 3 (Also see S-register description).

- AT W0** Upon connection, the modem reports only the DTE speed (e.g. CONNECT 9600). Subsequent responses are disabled.
- AT W1** Upon connection, the modem reports the line speed, the error correction protocol, and the DTE speed, respectively. Subsequent responses are disabled (default).
- AT W2** Upon connection, the modem reports the DCE speed (e.g. CONNECT 2400). Subsequent responses are disabled.

Extended result codes.

This command selects which subset of the result messages will be used by the modem to inform the DTE of the results of commands. Blind dialling is enabled or disabled by country parameters. If the user wishes to enforce dial tone detection, a "W" can be placed in the dial string (see D command). Table 3-1 indicates the messages which are

enabled for each X value.

If the modem is in facsimile mode (+FCLASS=1 or 2), the only message sent to indicate a connection is CONNECT without a speed indication.

- AT X0** Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, and NO ANSWER result codes. Blind dialling enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 000b is written to S22 bits 6, 5, and 4, respectively.

Note:

It is **not** allowed to use this command in Sweden.

- AT X1** Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX (XXXX = rate). Blind dialling enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial one is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 100b is written to S22 bits 6, 5, and 4, respectively.

Note:

It is **not** allowed to use this command in Sweden.

- AT X2** Disables monitoring of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO DIALTONE, NO ANSWER, and CONNECT XXXX. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 101b is written to S22 bits 6, 5, and 4, respectively.

Note:

It is **not** allowed to use this command in Sweden.

AT X3 Enables monitoring of busy tones; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO DIALTONE, NO ANSWER, and CONNECT XXXX. Blind dialling enabled/disabled by country parameters. If dial tone detection is enforced and dial tone is not detected, NO CARRIER will be reported. The value 110b is written to S22 bits 6, 5, and 4, respectively.

AT X4 Enables monitoring of busy tones; send all messages. The value 111b is written to S22 bits 6, 5, and 4, respectively (default).

Long space disconnect.

This command enables/disables the generation and response to long space disconnect. The parameter value, if valid, is written to S21 bit 7.

AT Y0 Disables long space disconnect (default).

AT Y1 Enables long space disconnect. In non-error correction mode, the modem will send a long space of four seconds prior to going on-hook. In error correction mode, the modem will respond to the receipt of a long space (i.e. a break signal greater than 1.6 seconds) by going on-hook.

Soft reset and restore profile.

The modem performs a soft reset and restores (recalls) the configuration profile according to the parameter supplied. If no parameter is specified, zero is assumed.

AT Z0 Soft reset and restore stored profile 0.

AT Z1 Soft reset and restore stored profile 1.

ATI Commands.**Select maximum MNP block size.**

The modem will operate an MNP error corrected link using a maximum block size controlled by the parameter supplied. The parameter value, if valid, is written to S40 bits 6 and 7.

AT \A0 64 characters.

AT \A1 128 characters (default).

AT \A2 192 characters.

AT \A3 256 characters.

Transmit break to remote.

In non-error correction mode, the modem will transmit a break signal to the remote modem with a length in multiples of 100 ms according to parameter specified. If a number in excess of 9 is entered, 9 is used. The command works in conjunction with the VK command.

In error correction mode, the modem will signal a break through the active error correction protocol, giving no indication of the length.

AT \B1-

AT \B9 Break length in 100 ms units. (default = 3) (Non-error corrected mode only).

Display telephone directory.

AT \F The modem displays the telephone directory entries which were stored with the &Z command.

Modem-to-modem flow control (XON/XOFF).

In non-error correction mode, the modem enables or disables the generation or recognition of modem-to-modem XON/XOFF flow control according to the parameter supplied. The parameter value, if valid, is written to S41 bit 3.

In error correction mode, the setting of modem-to-modem XON/XOFF

flow control is ignored. However, the serial port flow control settings (AT&K) remain active during a reliable link. Due to the buffering system used in the modem, modem-to-modem flow control is normally disabled.

AT \G0 Disables modem-to-modem XON/XOFF flow control (default).

AT \G1 Enables modem-to-modem XON/XOFF flow control.

Enable DTE auto rate adjustment.

Controls whether the modem will adjust the DTE speed to match the line speed when the connection is complete. The parameter value, if valid, is written to S41 bit 5.

AT \J0 Disable adjustment of DTE speed to match line speed.

AT \J1 Enable adjustment of DTE speed to match line speed.

Break control.

Controls the response of the modem to a break received from the DTE or the remote modem or the \B command according to the parameter supplied. The parameter value, if valid, is written to S40 bits 3, 4, and 5.

The response is different in three separate states.

The first state is where the modem receives a break from the DTE when the modem is operating in data transfer mode:

AT \K0 Enter on-line command mode, no break sent to the remote modem.

AT \K1 Clear data buffers and send break to remote modem.

AT \K2 Same as 0.

AT \K3 Send break to remote modem immediately.

AT \K4 Same as 0.

AT \K5 Send break to remote modem in sequence with transmitted data (default).

The second case is where the modem is in the on-line command state (waiting for AT commands) during a data connection, and the \B is received in order to send a break to the remote modem:

AT \K0 Clear data buffers and send break to remote modem.

AT \K1 Clear data buffers and send break to remote modem (same as 0).

AT \K2 Send break to remote modem immediately.

AT \K3 Send break to remote modem immediately (same as 2).

AT \K4 Send break to remote modem in sequence with data.

AT \K5 Send break to remote modem in sequence with data (same as 4) (default).

The third case is where a break is received from a remote modem during a non-error corrected connection:

AT \K0 Clears data buffers and sends break to the DTE.

AT \K1 Clears data buffers and sends break to the DTE (same as 0).

AT \K2 Send a break immediately to DTE.

AT \K3 Send a break immediately to DTE (same as 2).

AT \K4 Send a break in sequence with received data to DTE.

AT \K5 Send a break in sequence with received data to DTE (same as 4) (default).

Note:

that when S82 is modified, the modem converts the Hayes specific value to the \K format and updates S40 to match.

MNP block/stream mode select.

At connection time, this command controls the selection between block and stream modes of operation in MNP. The parameter value, if valid, is written to S4I bit 4.

AT \L0 Use stream mode for MNP connection (default).

AT \L1 Use interactive block mode for MNP connection. This command will accept block mode but implement stream mode.

Operating mode.

This command controls the preferred error correcting mode to be negotiated in a subsequent data connection.

AT \N0 Selects normal speed buffered mode (disables error-correction mode) (Forces &Q6).

AT \N1 Selects direct mode and is equivalent to &M0, &Q0 mode of operation (Forces &Q0).

AT \N2 Selects reliable (error-correction) mode. The modem will first attempt a LAPM connection and then an MNP connection. Failure to make a reliable connection results in the modem hanging up (Forces &Q5, S36=4, and S48=7).

AT \N3 Selects auto reliable mode. This operates the same as \N2 except failure to make a reliable connection results in the modem falling back to the speed buffered normal mode (Forces &Q5, S36=7, and S48=7).

AT \N4 Selects LAPM error-correction mode. Failure to make an LAPM error correction connection results in the modem hanging up (Forces &Q5 and S48=0).

Note:

The -K1 command can override the \N4 command.

AT \N5 Selects MNP error-correction mode. Failure to make an MNP error correction connection results in the modem hanging up (Forces &Q5, S36=4, and S48=128).

Report active configuration.

AT \S The modem reports the current (active) configuration for display.

Example:

CMD DESCRIPTION / OPTION	CMD DESCRIPTION / OPTION	CMD DESCRIPTION / OPTION
DTE BPS.....9600	4C DCD OPTION.....1	1M CELLULAR.....OFF
DTE PARITY.....NONE	4D DTR OPTION.....2	S0 RINGS TO ANSWER.....000
DIAL MODE.....TONE	4G GUARD TONE.....1800	S1 RING COUNT.....000
LINE SPEED.....NONE	4K FLOW CONTROL.....RTS	S2 <ESC> CHAR.....043
B BELL MODE.....OFF	4L NETWORK.....PSTN	S3 <CR> CHAR.....013
E CHD ECHO.....ON	4P PULSE MODE.....0	S4 <LF> CHAR.....010
F LINE MODE.....AUTO	4Q ASYNC/SYNC.....5	S5 <BS> CHAR.....008
L SPKR VOLUME.....LOW	4R RTS/CTS.....1	S7 CONNECT TIME.....050
M SPKR CONTROL.....1	4S DSR OPT.....1	S8 PAUSE TIME.....002
N AUTO MODE.....ON	4T ENABLE ROL.....YES	S12 ESC GUARD TIME.....050
Q QUIET.....OFF	4X SYNC CLOCK.....INT	S24 SLEEP INACT.....000
V RESULT FORM.....LONG	4Y PROFILE.....NVM.0	S30 CONNECT INACT.....000
W EC MSG.....1	4A MAX BLK SIZE.....128	S32 XON CHAR.....017
K EXT RESULTS.....4	4G REMOTE FLOW.....OFF	S33 XOFF CHAR.....019
Y LONG SPACE DISC.....NO	4K BRK OPT.....5	S36 FALLBACK ACTION.....007
4C COMPRESSION.....BOTH	4N ECL MODE.....AUTO	S37 MODE SELECT.....000
4E AUTO RETRAIN.....RTN	4W SPLIT SPEED.....OFF	S48 V42 NEG CTRL.....007
-K EXT. SERVICES.....0	*H NEG. SPEED.....HIGH	S95 RES. CODE.....032

OK

Split-Speed Operation

This command supports a split-speed DCE/DTE interface for applications such as Viewdata terminals which require a transmit speed of 75 bps and receive speed of 1200 bps at the DTE interface. The parameter value, if valid, is written to S28 bit 0.

AT \W0 Disables split-speed mode (default).

AT \W1 Enables split-speed mode. V.23 operation is also forced as though F3 had been entered.

Note:

that %Fn command determines the split screen direction.

AT& Commands.**RLSD (DCD) option.**

The modem controls the RLSD output in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bit 5.

AT &C0 RLSD remains ON at all times.

AT &C1 RLSD follows the state of the carrier (default).

DTR option.

This command interprets the ON to OFF transition of the DTR signal from the DTE in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bits 3 and 4.

AT &D0 DTR drop is interpreted according to the current &Q setting as follows:

&Q0, &Q5, &Q6	DTR is ignored (assumed ON). Allows operation with DTEs which do not provide DTR.
&Q1, &Q4	DTR drop causes the modem to hang up. Auto-answer is not affected.
&Q2, &Q3	DTR drop causes the modem to hang up. Auto-answer is inhibited.

AT &D1 DTR drop is interpreted according to the current &Q setting as follows:

&Q0, &Q1, &Q4, &Q5, &Q6	DTR drop is interpreted by the modem as if the asynchronous escape sequence had been entered. The modem returns to asynchronous command state without disconnecting.
&Q2, &Q3	DTR drop causes the modem to hang up. Auto-answer is inhibited.

AT &D2 DTR drop is interpreted according to the current &Q setting as follows:

&Q0 through &Q6	DTR drop causes the modem to hang up. Auto-answer is inhibited (default).
-----------------	--

AT &D3 DTR drop is interpreted according to the current &Q setting as follows:

&Q0, &Q1, &Q4, &Q5, &Q6	DTR drop causes the modem to perform a soft reset as if the Z command were received. The &Y setting determines which profile is loaded.
&Q2, &Q3	DTR drop causes the modem to hang up. Auto-answer is inhibited.

If &Q5, &Q6, +FCLASS=1 or +FCLASS=2 is in effect, the action taken is the same as for &Q0.

Restore factory configuration (profile).

The modem loads the factory default configuration profile according to the parameter supplied. The factory defaults for profile 0 (&F0) are quoted for each command and in the S register descriptions. Two profiles are available. A configuration profile consists of a subset of S-registers.

AT &F0 Recall factory profile 0 (default).

AT &F1 Recall factory profile 1.

Select guard tone.

The modem generates the guard tone selected by this command according to the parameter supplied (DPSK modulation modes only). The parameter value, if valid, is written to S23 bits 6 and 7.

AT &G0 Disables guard tone.

AT &G1 Disables guard tone.

AT &G2 Selects 1800 Hz guard tone (default).

Note:

This command may not be permitted in some countries.

Telephone jack control.

This command is only included for compatibility and performs no function except to load the S-register. The parameter value, if valid, is written S21 bit 1.

AT &J0 &J0 command (default).

AT &J1 &J1 command.

Flow control.

This command defines the DTE/DCE (terminal/modem) flow control mechanism. The parameter value, if valid, is written to S39 bits 0, 1, and 2.

AT &K0 Disables flow control.

AT &K3 Enables RTS/CTS flow control (default for data modem modes).

AT &K4 Enables XON/XOFF flow control.

AT &K5 Supports transparent XON/XOFF flow control.

AT &K6 Enables both RTS/CTS and XON/XOFF flow control. (default for fax modem modes).

Leased line operation.

This command selects leased or dial-up line operation for compatibility. The OK response is returned for a valid parameter. The parameter value, if valid, is written to S27 bit 2.

AT &L0 Selects dial-up line operation.

AT &L1 Selects leased line operation.

Asynchronous/synchronous mode selection.

This command determines the DTR operating mode. The modem treats the &M command as a subset of the &Q command.

AT &M0 Selects direct asynchronous operation.

Note:

that the command sequence &M0\N0 selects normal buffered mode, but the command sequence \N0&M0 selects direct mode. This is because the \N0 command is analogous to the &Q6 command.

The value 000b is written to S27 bits 3, 1, and 0, respectively (see &Q).

AT &M1 Selects synchronous connect mode with async off-line command mode. The value 001b is written to S27 bits 3, 1, and 0, respectively.

AT &M2 Selects synchronous connect mode with async off-line command mode. Same as &M1 except that &M2 enables DTR dialling of directory slot 0. The modem will disconnect if DTR is OFF for more than the period in S25 (in units of hundredths of a second); the data connection will be synchronous. The value 010b is written to S27 bits 3, 1, and 0, respectively.

AT &M3 Selects synchronous connect mode. This mode allows DTR to act as a talk/data switch. The call is manually initiated while DTR is inactive. When DTR becomes active, the handshake proceeds in originate or answer mode according to S14 bit 7. The value 011b is written to S27 bits 3, 1, and 0, respectively.

Select pulse dial make/break ratio.

This command determines the make/break ratio used during pulse dialling. This command may not be permitted in some countries. The parameter value, if valid, is written to S28 bits 3 and 4.

AT &P0 Selects 39%-61% make/break ratio at 10 pulses per second.

AT &P1 Selects 33%-67% make/break ratio at 10 pulses per second.

AT &P2 Selects 39%-61% make/break ratio at 20 pulses per second.

AT &P3 Selects 33%-67% make/break ratio at 20 pulses per second.

Synch/async mode.

This command is an extension of the &M command and is used to control the connection modes permitted. It is used in conjunction with S36 and S48. (Also, see \N.)

- AT &Q0** Selects direct asynchronous operation. See &M0.
- AT &Q1** Selects synchronous connect mode with async off-line command mode. See &M1.
- AT &Q2** Selects synchronous connect mode with async off-line command mode. See &M2.
- AT &Q3** Selects synchronous mode. See &M3.
- AT &Q4** Selects autosync operation. The value 100b is written to S27 bits 3, 1, and 0, respectively.
- AT &Q5** The modem will try to negotiate an error-corrected link. The modem can be configured using S36 to determine whether a failure will result in the modem returning on-hook or will result in fallback to an asynchronous connection. The value 101b is written to S27 bits 3, 1, and 0, respectively (default).
- AT &Q6** Selects asynchronous operation in normal mode (speed buffering). The value 110b is written to S27 bits 3, 1, and 0, respectively.

RTS/CTS option.

This selects how the modem controls CTS. CTS operation is modified if hardware flow control is selected (see &K command).

- AT &R0** In sync mode, CTS tracks the state of RTS; the RTS-to-CTS delay is defined by S26. In async mode, CTS acts according to V.25 bis handshake.
- AT &R1** In sync mode, CTS is always ON (RTS transitions are ignored). In async mode, CTS will only drop if required by flow control (default).

DSR override.

This command selects how the modem will control DSR. The parameter value, if valid, is written to S21 bit 6.

- AT &S0** DSR will remain ON at all times.
- AT &S1** DSR will become active after answer tone has been detected and inactive after the carrier has been lost (default).

Test and diagnostics.

The modem will perform selected test and diagnostic functions according to the parameter supplied. A test can be run only when in an asynchronous operation in non-error-correction mode (normal or direct mode). To terminate a test in progress, the escape sequence must be entered first, except for parameters 7 and 8 (see Section 3.1.3). If S18 is non-zero, a test will terminate automatically after the time specified by S18 and display the OK message. Test commands may not be available in some countries due to PTT restrictions.

- AT &T0** Terminates test in progress. Clears S16.
- AT &T1** Initiates local analog loopback, V.54 Loop 3. Sets S16 bit 0. If a connection exists when this command is issued, the modem hangs up. The CONNECT XXXX message is displayed upon the start of the test.
- AT &T2** Returns ERROR.
- AT &T3** Initiates local digital loopback, V.54 Loop 2. Sets S16 bit 2. If no connection exists, ERROR is returned. Sets S16 bit 4 when the test is in progress.
- AT &T4** Enables digital loopback acknowledgment for remote request, i.e., an RDL request from a remote modem is allowed. Sets S23 bit 0 (default).
- AT &T5** Disables digital loopback acknowledgment for remote request, i.e., an RDL request from a remote modem is denied. Clears S23 bit 0.
- AT &T6** Requests a remote digital loopback (RDL), V.54 Loop 2, without self test.

If no connection exists, ERROR is returned. Sets S16 bit 4 when the test is in progress. The CONNECT XXXX message is displayed upon the start of the test.

AT &T7 Requests a remote digital loopback (RDL), V.54 Loop 2, with self test. (In self test, a test pattern is looped back and checked by the modem.) If no connection exists, ERROR is returned. When the test is terminated either via expiration of S18, or via the &T0 or H command, the number of detected errors is reported to the DTE. Sets S16 bit 5 when the test is in progress.

AT &T8 Initiates local analog loopback, V.54 Loop 3, with self test. (In self test, a test pattern is looped back and checked by the modem.) If a connection exists, the modem hangs up before the test is initiated. When the test is terminated either via expiration of S18, or via the &T0 or H command, the number of detected errors is reported to the DTE. Sets S16 bit 6 when the test is in progress.

Display current configuration and stored profiles.

AT &V Reports the current (active) configuration, the stored (user) profiles, and the first four stored telephone numbers.

Example:

```

ATEV
ACTIVE PROFILE:
B0 E1 L1 M1 N1 O0 T V1 W0 X4 Y0 A00 A00 A02 A03 A05 A06 A07 A08 A09 A10
S00:002 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:030 S08:002 S09:006
S10:014 S11:25 5 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S46:138
S48:007 S95:000

STORED PROFILE 0:
B0 E1 L1 M1 N1 O0 T V1 W0 X4 Y0 A00 A00 A02 A03 A05 A06 A07 A08 A09 A10
S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:105 S41:003 S46:138 S95:000

STORED PROFILE 1:
B0 E1 L1 M1 N1 O0 T V1 W0 X4 Y0 A00 A00 A02 A03 A05 A06 A07 A08 A09 A10
S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000
S36:007 S37:000 S40:105 S41:003 S46:138 S95:000

TELEPHONE NUMBERS:
0 = 1 =
2 = 3 =
OK

```

Store current configuration.

Saves the current (active) configuration (profile), including S registers, in one of the two user profiles in NVRAM as denoted by the parameter

value.

The current configuration is comprised of a list of storable parameters illustrated in the &V command. These settings are restored to the active configuration upon receiving an Zn command or at power up (see &Yn command).

AT &W0 Store the current configuration as profile 0.

AT &W1 Store the current configuration as profile 1.

Select synchronous clock source.

Selects the source of the transmit clock for the synchronous mode of operation. The parameter value, if valid, is written to S27 bits 4 and 5. In asynchronous mode, the transmit and receive clocks are turned OFF. In synchronous mode, the clocks are turned ON with the frequency of 1200 Hz or faster corresponding to the speed that is selected for modem operation.

AT &X0 Selects internal timing. The modem generates the transmit clock signal and applies it to the TXCLK output at the serial interface (default).

AT &X1 Selects external timing. The local DTE sources the transmit clock signal on the XTCLK input of the serial interface. The modem applies this clock to the TXCLK output at the serial interface.

AT &X2 Selects slave receive timing. The modem derives the transmit clock signal from the incoming carrier and applies it to the TXCLK output at the serial interface.

Designate a default reset profile.

Selects which user profile will be used after a hard reset.

AT &Y0 The modem will use profile 0.

AT &Y1 The modem will use profile 1.

Store telephone number.

The modem can store up to 20 telephone numbers. Each telephone number dial string can contain up to 45 digits.

AT&Zn=x n=0 to 19 and x = dial string

AT% Commands**Enable/disable data compression.**

Enables or disables data compression negotiation. The modem can only perform data compression on an error corrected link. The parameter value, if valid, is written to S41 bits 0 and 1.

AT %C0 Disables data compression. Resets S46 bit 1.

AT %C1 Enables MNP 5 data compression negotiation. Resets S46 bit 1.

AT %C2 Enables V.42 bis data compression. Sets S46 bit 1.

AT %C3 Enables both V.42 bis and MNP 5 data compression. Sets S46 bit 1 (default).

Enable/disable line quality monitor and auto-retrain or fallback/fall forward.

Controls whether or not the modem will automatically monitor the line quality and request a retrain (%E1) or fall back when line quality is insufficient or fall forward when line quality is sufficient (%E2). Applies to dial-up line only. The parameter value, if valid, is written to S41 bits 2 and 6.

If enabled, the modem attempts to retrain for a maximum of 30 seconds.

AT %E0 Disable line quality monitor and auto-retrain (default).

AT %E1 Enable line quality monitor and auto-retrain.

AT %E2 Enable line quality monitor and fallback/fall forward.

Fallback/Fall Forward. When %E2 is active, the modem monitors the line quality (EQM). When line quality is insufficient, the modem will initiate a rate renegotiation to a lower speed within the V.32 bis/V.32 modulation speeds. The modem will keep falling back if necessary until the speed reaches 4800 bps. Below this rate, the modem will only do retrains if EQM thresholds are exceeded. If the EQM is sufficient for at least one minute, the modem will initiate a rate renegotiation to a higher speed within the V.32/V.32bis modulation speeds. The rate renegotiations will be done without a retrain if a V.32bis connection is established.

Speeds attempted during fallback/fall forward are those shown to be available in the rate sequences exchanged during the initial connection. Fallback/fall forward is available in error correction and normal modes, but not in direct mode or synchronous mode with external clocks.

Split-speed direction select.

Determines which direction (transmit or receive) has the 75 bps channel, and which has the 1200 bps channel. This command is only valid if the \W1 command has been executed.

AT %F1 Selects 75Tx/1200Rx. Resets S28 bits 1 and 2 (default).

AT %F2 Selects 1200Tx/75Rx. Sets S28 bit 1 and resets S28 bit 2.

Line signal level.

AT %L Returns a value which indicates the received signal level. The value returned is a direct indication (line interface dependent) of the receive level at the MDP, not at the telephone line connector. For example, 009 = -9 dBm, 043 = -43 dBm, and so on.

AUXCTL output line control.

This command is included for compatibility and performs no function except to issue a result code.

AT %M0 Command ignored returns an "OK".

AT %M1 Command ignored returns an "OK".

Line signal quality.

AT %Q Reports the line signal quality (line interface). Returns the higher order byte of the EQM value. Based on the EQM value, retrain or fallback/fall forward may be initiated if enabled by %E1 or %E2.

Note:

ERROR returned if connected in 300 bps V.23 or fax modes.

Example: AT%Q
015

PTT testing utilities.

AT %T Facilitates PTT testing of signal levels by providing continuous signals regardless of whether the modem is connected or not. The signal transmitted is in accordance with the parameter provided.

This is a range of commands that allow the user to initiate a series of signals that are necessary for PTT approval. The signals emitted include answer tone, modulation, carriers, and other pertinent signals. A test is initiated upon receipt of an %TT (T is a password), and the test is aborted when any keyboard character is entered. The modem will continuously transmit the tone or carrier according to the parameter supplied.

AT %TT00-09	DTMF tone dial digits 0 to 9.
AT %TT0A	DTMF digit *.
AT %TT0B	DTMF digit A.
AT %TT0C	DTMF digit B.
AT %TT0D	DTMF digit C.
AT %TT0E	DTMF digit #.
AT %TT0F	DTMF digit D.
AT %TT10	V.21 channel no. 1 mark (originate) symbol.
AT %TT11	V.21 channel no. 2 mark symbol.
AT %TT12	V.23 backward channel mark symbol.
AT %TT13	V.23 forward channel mark symbol.
AT %TT14	V.22 originate (call mark) signalling at 600 bps.
AT %TT15	V.22 originate (call mark) signalling at 1200 bps.

AT %TT16	V.22 bis originate (call mark) signalling at 2400 bps.
AT %TT17	V.22 answer signalling (guard tone if PTT required).
AT %TT18	V.22 bis answer signalling (guard tone if required).
AT %TT19	V.21 channel no. 1 space symbol.
AT %TT1A	V.21 channel no. 2 space symbol.
AT %TT1B	V.23 backward channel space symbol.
AT %TT1C	V.23 forward channel space symbol.
AT %TT1D	V.27 ter carrier.
AT %TT1E	V.29 carrier.
AT %TT20	V.32 9600 bps.
AT %TT21	V.32 bis 14400 bps.
AT %TT22	V.17 14400 bps
AT %TT30	Silence (on-line), i.e., go off-hook.
AT %TT31	V.25 answer tone.
AT %TT32	1800 Hz guard tone.
AT %TT33	V.25 calling tone (1300 Hz).
AT %TT34	Fax calling tone (1100 Hz).

To permit output signal spectra measurement, data can be transmitted in the absence of a received signal by setting S10 equal to 255.

AT* Commands.

Display blacklisted numbers.

AT *B This command requests the modem to return a list of blacklisted numbers to the DTE. The format of the response is shown by the example below. Permanently forbidden numbers as defined by country requirements will not appear on this list. If no numbers are blacklisted, only the OK result code is issued.

Example:

NO. - PHONE NUMBER -

```
-----
1; 4175537660
2; 8288924961
3; 3887278862
4; 3124839442
5; 6284664
```

OK

Remote configuration password.

AT *C This command instructs the modem to store a password. Following this command, the response "ENTER PASSWORD" is generated, after which the new password should be entered. The password supplied by a remote modem wishing to reconfigure this local modem must match the password stored by the local modem in response to the *C command. The password must be alphanumeric and between 6 and 12 characters in length. This command works only with MNP connections. The default password is QWERTY. (Also, see *E and *R commands).

Display delayed numbers.

AT *D This command causes the modem to send a list of the delayed numbers together with the delay associated with each. The modem will return a list of delayed telephone numbers as defined in the *B command. The format of the response is shown by the example below (delay times are shown hours:minutes:seconds). If no numbers are delayed, only the OK result code is issued.

Example:

NO. - PHONE NUMBER -DELAY

```
-----
1; 8264734660 2:00:00
2; 7532634661 2:00:00
3; 2587334662 0:02:00
4; 7532651663 0:03:25
5; 7459931664 0:01:45
```

OK

Exit remote configuration mode.

AT *E Upon receipt of this command from the telephone line, the modem will exit remote configuration mode and transmit the OK result code to the line. (Also, see register S202).

Link negotiation speed.

This command controls the connection speed for link negotiations before upshift occurs between two MNP Class 10 modems. The parameter value, if valid, is written to S40 bit 2.

AT *H0 Link negotiation occurs at the highest supported speed (default).

AT *H1 Link negotiation occurs at 1200 bps.

AT *H2 Link negotiation occurs at 4800 bps.

Display secure access (callback) directory.

AT *L The modem will display all secure access (callback) directory entries.
Format:
Entry Number - Password:Callback Number.

Example:

```
0-MERAS02 (Password entered; no callback number)
1-872FRD:345-7895551212 (Password entered; callback number)
2-
3-
4-
5-
6-
7-
8-
9-
10-
11-
12-
13-
14-
15-
16-
17-
18-
19-
OK
```

Country select.

AT *NCnn

Up to eight sets of country parameters may be available. This command checks to see if the entered number matches the country code of one of the countries supported. If found, the modem stores the location of that country in NVRAM. Upon power up or a soft reset (Z command), the modem uses this location to load the parameters for the corresponding country.

Select country parameters corresponding to entered country code (nn).

The country codes are:

Country	Code (nn)
Australia	40
Austria	1
Belgium	2
Canada	20
Denmark	3
Finland	4
France	5
Germany	6
Ireland	7
Italy	8
Japan	43
Luxembourg	9
Mexico	21
Netherlands	10
New Zealand	48
Norway	11
Portugal	12
Singapore	47
Spain	13
Sweden	14
Switzerland	15
United Kingdom	16
United States	22

Store callback password.

AT *P

This command causes the modem to store a password and to store or delete a corresponding telephone number in NVRAM. The password will be used to match that supplied by a remote modem when secure access is used. The modem will use the telephone number to dial back the remote modem. The password must be between 6 and 12 characters in length. The telephone number length is 40 characters maximum. If the number to be dialled back (along with the final colon) is omitted, a password check will be performed, but no callback will occur. Up to 20 password/telephone number pairs may be entered.

AT *Pn: <password>:<number to be dialled back> n: 0 to 19.

Request remote configuration mode.

AT *R

This command from the DTE requests that the local modem attempt to place the remote modem in remote configuration mode. This command will only be accepted if the local modem is in on-line command state during an MNP error corrected link. Enter the password (from 6 to 12 characters in length) after the REMOTE PASSWORD prompt is displayed by the local DTE. The entered password is inserted in a remote configuration request (a special MNP frame) and is sent to the remote modem.

Following a successful request, indicated by the display of the !AT prompt by the local DTE, the local DTE may send commands to the remote modem. These commands, a subset of the normal commands available, should be entered without the 'AT' header. Some commands are prohibited and others may produce unpredictable results. To exit the remote configuration mode, enter the *E command or the escape sequence defined by register S202. The default password is QWERTY. (Also, see *C and *E commands and register S202.)

AT -Commands.

MNP extended services.

Enables or disables conversion of a V.42 LAPM connection to an MNP 10 connection. The parameter value, if valid, is written to S40 bit 0.

AT -K0 Disables V.42 LAPM to MNP 10 conversion (default).

AT -K1 Enables V.42 LAPM to MNP 10 conversion.

Enable fallback to V.22 bis/V.22.

Enables or disables fallback from MNP 10 to V.22 bis/V.22. The parameter value, if valid, is written to S40 bit 1.

AT -Q0 Disables fallback to 2400 bps (V.22bis) and 1200 bps (V.22). Fallback is enabled only to 4800 bps.

AT -Q1 Enables fallback to 2400 bps (V.22bis) and 1200 bps (V.22) (default).

AT) commands.**Enable cellular power level adjustment.**

Enables or disables automatic adjustment of the transmit power level during link negotiation for reliable links to accommodate the signalling requirements of cellular telephone equipment. The parameter value, if valid, is written to S40 bit 2.

AT)M0 Disables power level adjustment during MNP 10 link negotiation (default).

AT)M1 Enables power level adjustment during MNP 10 link negotiation.

3.2 V.25bis Command Set.

Modem operation may be controlled through the use of the V.25 bis command set. This is implemented by command, response, and circuit signalling providing addressed call and/or answer via circuit 108/2 in accordance with V.25 bis. V.25 bis is a CCITT recommendation that defines a method of exchanging commands and indications across a DTE interface (EIA-232/V.24). V.25 bis defines modem behaviour only while the modem is disconnected from the line, or while the modem is off-hook and is attempting to establish a connection. The following terms are used in the V.25 bis description.

COMMAND: An instruction issued by the DTE to the modem as part of the automatic calling procedure.

INDICATION: A response message issued by the modem to the DTE as part of the automatic calling procedure.

PARAMETER: A variable which may accompany commands or indications. In general, more than one parameter may be used in a command or indication.

3.2.1 DTE/DCE Interchange Circuits.

Communication between the DTE and modem is half duplex.

The DTE is the 'master' and the modem is the 'slave'. Only the DTE initiates V.25 bis communications, while the modem just responds.

When the modem is in data transfer mode after the connection has been

established, the modem is no longer in V.25 bis mode.

During automatic calling and answering procedures, RLSD (CT109) follows the condition of RTS (CT106).

3.2.2 Formats for Commands and Indications.

The modem will accept commands either in synchronous mode HDLC (NRZ or NRZI), BSC, or in asynchronous mode. The command set conforms to the CCITT recommendation with two extensions for asynchronous mode.

3.2.2.1 Synchronous Signalling.

The modem can automatically detect and switch from HDLC framing to BSC framing.

HDLC frames.

HDLC frames, commands, and indications are HDLC frames with data fields called messages.

FLAG	7Eh
ADDRESS	FFh
CONTROL	13h
MESSAGE	Data. Must be an integer number of 8-bit characters between 3 and 60.
FCS	Sixteen-bit cyclic redundancy check based on the polynomial: $X^{16} + X^{12} + X^5 + X^1$.

Framing rules.

Frames may be preceded and followed by any data including additional flags.

A frame with an address, control, or FCS field error is invalid. A frame with more than 60 characters in the message field is invalid. A frame with 3 or less characters in the message field is rejected with the INV indication. Invalid frames are ignored.

For every valid command frame received, the modem responds with exactly one indication if the connection is not completed, and no

indication if the connection is completed.

When the modem receives a valid command frame, it will ignore another command frame until it has completed sending its indication back to the attached DTE, or until the connection is terminated, whichever occurs last.

The modem can accept a valid command frame that follows an invalid frame if there is a pause of at least 2 bit times between the end of the invalid frame and the start of the valid frame.

The modem automatically detects whether each command frame is NRZ or NRZI encoded and follows suit for its indication.

Command and indication frames contain inserted zero bits as required by HDLC. The receiving entity (modem or DTE) strips out these extra bits.

BSC frames.

The format for synchronous character oriented format shall be in accordance with ISO 1745.

SYN	16h
SYN	16h
STX	02h
MESSAGE	Data. Must be an integer number of 8-bit characters between 3 and 60.
ETX	83h

Framing rules.

Frames may be preceded and followed by any data including additional SYN characters.

A frame with a parity error is invalid. A frame with more than 60 characters in the message field is invalid. A frame with 3 or less characters in the message field is invalid. An invalid frame will be rejected with the INV indication.

For every valid command frame received, the modem responds with exactly one indication if the connection is not completed, and no indication if the connection is completed. The modem does not recognize or send any of the short 'ack' type messages used in character oriented protocols.

When the modem receives a valid command frame, it will ignore another command frame until it has completed sending its indication

back to the attached DTE, or until the connection is terminated, whichever occurs last.

The modem can accept a valid command frame that follows an invalid frame if there is a pause of at least 2-bit times between the end of the invalid frame and the start of the valid frame.

3.2.2.2 Asynchronous Signalling.

The format for the asynchronous character oriented format is:

MESSAGE <CR> <LF>

The default data rate for commands and parameters is the maximum data rate permitted by the modem.

The message field can contain between 3 and 60 8-bit characters (7-bit IA5 per T.50 plus odd parity per V.4) which define the parameters. Each frame can contain only one command followed by multiple parameters as will fill the limit.

Command/indication exchange protocol.

The modem will ignore any command issued with incorrect parity. The modem will ignore a command issued from the DTE before it has completed execution of the previous command and given an appropriate response. The modem will ignore a command from the DTE while it is sending an indication to the DTE.

A command received with a message field of less than 3 characters or more than 60 characters is regarded as an error in the message and will result in the negative acknowledgment of the command by the return of the invalid message (INV).

DTE adaption.

In asynchronous mode, the modem performs an autobaud/autoparity/autolength function on the first characters received following a Power-On Reset or <CTRL> Z. If the modem receives a <CR> <LF> sequence, it is able to calculate the speed, parity, and the word length. If the modem receives only a <CR> character, it will calculate the speed but retain the existing parity and word length values. If the modem receives neither of these characters, it will continue to use the existing values for speed, parity, and word length. If no previous speed,

parity, and/or length information is available, the modem defaults to 7-bit even operation at 9600 bps. The autolength/autoparity facility is capable of detection of 7- or 8-bit characters of even, odd, or no parity with one stop bit. The modem then accepts and sends characters according to this selection of speed, parity, and length. The adaption algorithm is re-initialized by the next OFF-to-ON transition of CT108/2. In HDLC mode, the modem detects when DTE sends in NRZ or NRZI format, and adjusts its indication format accordingly.

3.2.3 V.25 bis Escape Code Sequence.

An escape sequence function for V.25 bis asynchronous operation is provided which operates exactly like the AT escape sequence. (See Section 3.1.)

3.2.4 Standard V.25 Bis Commands.

The following commands are implemented, and parameters applicable to each command are noted following the description of the command.

CIC - Connect Incoming Call.

The modem goes on-line in answer mode cancelling any DIC command previously issued. If no incoming call is present, the modem issues the invalid (INV) message.

CR1 - Call request with number and identification.

The modem goes on-line, dials according to the dial string entered, and attempts to establish a connection in the same manner as the CRN command except a ":" character and an identification character string can be inserted after the dial string. However, everything after the ":" character is ignored, i.e., the identification is not sent.

x..x Dial string: a string of dial characters (see CRN).
; Separator: inserted between dial string and identification.

Example:
CRN 234-1234;4567
VAL

CRN - Call request with number.

The modem goes on-line, dials according to the dial string entered, and attempts to establish a connection. The following dial modifiers are valid:

0-9 Digits 0 to 9.

* The 'star' digit: Tone dialling only.

The 'gate' digit: Tone dialling only.

T Select tone dialling: Affects current and subsequent dialling.

P Select pulse dialling: Affects current and subsequent dialling.

< Short dial pause: Period controlled by S8: The modem will pause before dialling the digits following "<."

= Long dial pause: Period twice as long as the short dial pause.

: Wait for dial tone: The modem will wait for dial tone before dialling the digits following ":".

& Flash: The modem will go off-line according to the value of S30.

^ Disable calling tone transmission: Applicable to current dial attempt only.

Example:

CRN 234-1234

VAL

CRS - Call request with memory address.

The modem goes on-line, dials according to the dial string entered in the dial string memory addressed (see PRN), and attempts to establish a connection.

0-19 Dial string memory address.

Example:

CRS 1 or CRS1

345-5678

VAL

DIC - Disregard incoming call.

The modem, though configured for auto-answer, will disregard the incoming call. If there is no incoming call or auto-answer is not enabled, the modem will issue the INV message.

PRI - Programme identification.

The modem returns VAL indication only.

PRN - Programme number.

The modem stores the dial string specified into the dial string memory referenced.

0-19 Dial string memory address.
 ; Separator: Inserted between dial string memory address and dial string.
 x..x Dial string: A string of dial characters: 0-9 * # T P = &: /:
 characters accepted: An empty string clears the identification memory referenced.

Example:

PRN 1;345-5678

VAL

RLD - List request of delayed call numbers.

The modem returns the list of numbers which have been delayed by country dependent blacklisting procedures.

Example:

NO. - PHONE NUMBER - DELAY

```
-----
LSN 1; 7503857609 2
LSN 2; 1349579050 1
LSN 3; 4146949385 1
LSN 4; 3479784564 3
LSN 5; 5529685740 1
VAL
```

RLF - List request of forbidden numbers.

The modem returns the list of numbers which have been blacklisted by country dependent blacklisting procedures.

Example:

NO. - PHONE NUMBER

```
-----
LSF 1; 6209567485
LSF 2; 4227458945
LSF 3; 2137874644
LSF 4; 5256677014
LSF 5; 0114418172323
LSF 6; 7228309
VAL
```

RLI - List request of identification numbers.

The modem returns the VAL message only.

Example:

LSI 1; 8183400

VAL

RLN - List request of stored numbers (dial strings).

The modem returns the dial string or the list of dial strings according to the parameter supplied.

0-19 Dial string memory address: If no address is supplied, a full list of all stored dial strings will be returned.

Examples:

LSN 4; 19:1=722340 Response to RLN4
 VAL

LSN 0; Response to RLN

```
LSN 1;
LSN 2;
LSN 3; 19:1=7223400
LSN 4;
LSN 5;
LSN 6;
LSN 7;
LSN 8; 93256642
LSN 9;
LSN10;
LSN11;
LSN12;
LSN13;
LSN14;
LSN15;
LSN16;
```

```
LSN17;  
LSN18;  
LSN19;  
LSN20;  
VAL
```

3.2.5 Extended V.25 Bis Commands.

There is one extension to the standard V.25 bis command set.

CNL - Local Configuration.

Any AT command string may be entered as a parameter of this command. This command is valid only in asynchronous mode. The format is:

CNL<AT command>

Example:

CNLS0=2

3.2.6 Standard V.25 Bis Indications.

The modem provides the indications/responses listed, and parameters applicable to each message are noted following the description of the response.

CFI - Call Failure Indication.

The modem sends this message when a call fails to connect. A parameter is included to give the reason for the failure.

AB	No dial tone or the call abort timer expired with no call progress tone detected or during handshaking after answer tone detected.
CB	Local circuit busy (phone off-hook).
ET	Busy (engaged tone) detected.
FC	Requested number on forbidden call list (call not placed).
NS	No number stored at dial string memory requested (call not placed).
NT	Ringback detected: Ringback stopped: Call abort timer expired with no answer tone detected.
RT	Ringback detected: Call abort timer expired with ringback still detected.

CNX - Connect.

The modem returns this message when a connection has been established. The message may be followed by a value indicating the connection speed.

Example:

CNX 9600

DLC - Delayed call.

The modem returns this message when a call fails to connect and the number dialled is considered 'delayed'. The message indicates the delay (in minutes) before the call may be re-attempted as shown in the following example:

DLCn (n = delay in minutes)

This message will be preceded by the message indicating call failure.

INC - Incoming call.

The modem sends this message when incoming ringing is detected on the line.

INV - Invalid command.

The modem sends this message if the command line contains a syntax error, or if the modem is unable to execute the command.

VAL - Valid command.

The modem sends this message when it successfully executes the command issued and there is no other applicable response (message or circuit transition).

3.3 Fax Class 1 Commands.

3.3.1 Fax I/O Processing.

The fax I/O interface supports asynchronous serial and parallel interfaces. The interface rate is 19200 bps. The character format is 8 bits data, no parity, and 1 stop bit. Start and stop elements are removed from the transmit data, and added to the receive data. Both transmit and receive data is buffered. Flow control using XON/XOFF (DC1/DC3) or RTS/CTS is provided.

Unique control character strings are identified, filtered, or reinserted into the I/O data stream. These control characters and their resultant action are described below.

3.3.1.1 DTE-to-Modem Transmit Data Stream.

Characters Detected	Action Taken
<DLE><data>	Delete <DLE><data> characters
<DLE><ETX>	Recognize as a string terminator, and take appropriate action
<DLE><DLE>	Replace with single <DLE> character.

3.3.1.2 Modem-to-DTE Receive Data Stream.

Characters Detected	Action Taken
<DLE>	Insert extra <DLE> ahead of <DLE>.

The modem also identifies the end of a frame by inserting <DLE><ETX> into the data stream after the FCS bytes.

3.3.1.3 Fax Mode Selection.

Fax class 1 commands are identified in Table 1. Fax modes and rates

are determined by the AT+F commands as described in Section 3.3.2.

Table 1 Fax Class 1 Commands

Command	Function
Service Class ID	
+FCLASS=	Service Class
Fax Class 1 Commands	
+FTS=n	Stop Transmission and Wait
+FRS=n	Receive Silence
+FTM=n	Transmit Data
+FRM=n	Receive Data
+FTH=n	Transmit Data with HDLC Framing
+FRH=n	Receive Data with HDLC Framing

3.3.1.4 Fax Origination.

Origination of fax calls is made using the ATD command. Upon completion of the dial function, a calling tone at 1100 Hz is transmitted, with a cadence of 0.5 seconds on and 3 seconds off. The modem automatically enters mode +FRH=3 and sends the CONNECT message to the DTE when FSK flags are detected from the remote.

3.3.1.5 Fax Answering.

Answering of fax calls is identical to answering of data calls with the exception that the modem enters the fax handshaking mode instead of the data handshaking mode after going off-hook. If +FAE=0, the modem, after sending answer tone, automatically enters fax mode (+FTH=3), sends the CONNECT

message to the DTE, and starts sending FSK flags. If +FAE=1, the modem determines if the caller is a data modem or fax modem and sends the DATA or FAX result code, respectively, to the DTE.

3.3.1.6 Fax Control Transmission.

Fax control transmission is initiated by the +FTH=n command. After this command is issued, the modem generates the CONNECT message and transmits carrier in the modulation scheme specified by the parameter n. The modem then transmits HDLC flags for a minimum of 1 second. The modem continues to transmit the HDLC flags until it receives a character from the DTE.

When characters are received from the DTE, the modem adds start and end flags, performs zero-bit insertion, generates FCS, and deletes <DLE><chr> character pairs before transmitting the characters to the remote fax machine. Each <DLE><DLE> sequence is transmitted as a single <DLE>. <DLE><ETX> is considered as the end of frame marker and is not transmitted. All data received from the DTE after <DLE><ETX> is ignored by the modem until the modem generates either the CONNECT, OK, or ERROR result code.

If no more data is in the transmit buffer and the final bit was a 1 (bit 4 of the second byte received from the DTE), the modem generates the OK result code and returns to the command mode. If the final bit was a 0, the modem generates the CONNECT message and waits for further data from the DTE while transmitting HDLC flags. If no more data is received before 5 seconds elapse, the modem drops carrier, goes on-hook, and generates the ERROR result code.

3.3.1.7 Fax Control Reception.

Fax control reception is initiated using the AT+FRH=n command. After this command is issued, the modem looks for

carrier in the modulation scheme specified by the parameter n. If no carrier is detected before the period of time specified by register S7 expires, the modem generates the NO CARRIER message and returns to command mode. If carrier is detected that is not the one specified by the parameter n, the modem generates the +FCERROR message and returns to the command mode. If the specified carrier is detected, the modem generates the CONNECT message and enters the HDLC receive mode.

In HDLC receive mode, the modem receives HDLC frames from the remote fax machine, strips the flags, performs zero-bit deletion, performs error checking, and handles <DLE><chr> character pairs before passing the data to the DTE. The modem prefixes each <DLE> character with another <DLE> character before sending it to the DTE. After the last byte in the frame, the modem sends <DLE><ETX> to the DTE marking the end of the frame. The modem then generates either the OK message if no errors were detected or the ERROR message if errors were detected (FCS is incorrect), and returns to command mode.

While in command mode, the modem continues to receive data in the selected modulation scheme, and sends the data after sending the CONNECT message to the DTE when the DTE reissues the +FRH command with the same parameter. If the DTE issues the +FRH command with a different parameter, the modem clears all buffers and proceeds as described previously.

If carrier is lost while in command mode and the DTE reissues the +FRH command with the same parameter, and there is no data in the buffer, the modem sends the ERROR result code to the DTE and returns to the command mode. If there is data in the buffer, the modem sends the next frame of buffered data to the DTE, followed by <DLE><ETX>, and either the ERROR result code if errors were detected or the OK result code if no errors were detected. The modem then returns to command mode.

The modem concludes an error is detected if the carrier is lost for any period of time during or before the reception of a frame. If carrier is lost for a time period longer than the time specified

by the register S10, the modem finishes delivering the data in the receive buffer (if any) to the DTE, sends <DLE><ETX>, generates the ERROR message, and returns to command mode. All subsequent data received from the remote is discarded.

If the modem detects a frame abort sequence (seven consecutive ones with no zero insertion) while it is waiting for a frame beginning flag (it was receiving HDLC flags), it will wait for the HDLC flags again until either carrier is lost, or the DTE aborts the process by sending an abort character or by dropping DTR with &D2 in effect. If the frame abort sequence is detected while the modem is receiving a frame it finishes delivering the data in the receive buffer (if any) to the DTE, sends <DLE><ETX>, generates the ERROR message, and returns to command mode. The modem keeps looking for HDLC flags followed by more data from the remote, with the selected modulation scheme.

If the modem detects a receive buffer overflow condition, it concludes that there was a FCS error in that frame. The modem will receive more frames only if a starting flag is detected and there is room in the receive buffer. If a starting flag is detected and there is no room in the buffer, the modem discards all data in that frame.

If the modem receives any character from the DTE after the +FRH command (except flow control characters if software flow control is in effect), or if the modem detects a high-to-low transition of the DTR signal while &D1 is in effect, it sends <DLE><ETX> to the DTE, generates OK result code, and returns to command mode. The receive buffer is cleared and all data received from the remote is discarded. If the modem detects a DTR drop while &D2 is in effect, it goes on-hook, sends <DLE><ETX> to the DTE, generates OK result code, and returns to command mode. If the modem detects a DTR drop while &D3 is in effect, the modem performs a warm reset.

3.3.1.8 Fax Data Transmission.

Fax data transmission is initiated by the AT+FTM=n command. After this command is issued, the modem generates the CONNECT message and transmits carrier in the modulation scheme specified by the parameter n. The modem then transmits constant 1 bits for a minimum of one second and continues to transmit constant 1 bits until it receives a character from the DTE.

When data is received from the DTE, the modem deletes start and stop bits and deletes all <DLE><chr> character pairs before transmitting the data to the remote. Each <DLE><DLE> sequence is transmitted as a single <DLE>. <DLE><ETX> is considered as the end of stream marker, and is not transmitted. All data received from the DTE after the <DLE><ETX> is ignored by the modem until the modem generates either the CONNECT, OK, or ERROR result code.

If no more data is in the transmit buffer, and the last transmitted character was not an ASCII NULL, the modem generates the OK result code and returns to the command mode. If the last character transmitted was an ASCII NULL, the modem generates the CONNECT message to the DTE and waits for further data from the DTE while transmitting NULLs to the remote. If more data is received before five seconds elapse, the modem continues to transmit the data as described in the previous paragraph. If five seconds elapse and no data is received from the DTE, the modem drops carrier, goes on-hook, and generates the ERROR result code.

3.3.1.9 Fax Data Reception.

Fax data reception is initiated using the AT+FRM=n command. After this command is issued, the modem looks for carrier in the modulation scheme specified by the parameter n. If no carrier is detected before the period of time specified by register S7 expires, the modem generates the NO CARRIER message and returns to command mode. If carrier is detected that is not the

one specified by the parameter n, the modem generates the +FCERROR message and returns to the command mode. If the specified carrier is detected, the modem generates the CONNECT message and enters the data receive mode.

While in data receive mode, the modem receives data from the remote, adds start and stop bits, and handles <DLE><chr> character pairs before passing the data to the DTE. The modem prefixes each <DLE> character with another <DLE> character before sending it to the DTE.

If carrier is lost for a time period longer than the time specified by the register S10, the modem finishes delivering the data in the receive buffer (if any) to the DTE, sends <DLE><ETX>, generates the NO CARRIER result code, and returns to the command mode. All subsequent data received from the remote is discarded.

If the modem detects a receive buffer overflow condition, it stops receiving from the remote until there is room in the receive buffer. The modem informs the DTE of the buffer overflow after it sends to the DTE the last character that was stored in the buffer before the overflow occurred.

If the modem receives any character from the DTE after the +FRM command (except flow control characters if software flow control is in effect), or if the modem detects a high-to-low transition of the DTR signal while &D1 is in effect, it sends <DLE><ETX> to the DTE, generates the OK result code, and returns to command mode. The receive buffer is cleared and all data received from the remote is discarded. If loss of DTR is detected while &D2 is in effect, the modem goes on-hook, sends <DLE><ETX> followed by OK result code to the DTE, and returns to command mode. If the modem detects a DTR drop while &D3 is in effect, the modem performs a warm reset.

3.3.2 Commands.

+FCLASS=n - Select Service Class

+FCLASS=n command sets the active service class.

Parameters: 0-2

Command options:

+FCLASS=0 Select Data Mode (Default.)

+FCLASS=1 Select Facsimile Class 1

+FCLASS=2 Select Facsimile Class 2

+F<command>? - Report Active Configuration

+F<command>? interrogates the modem to determine the active configuration.

Typical responses are:

+FAE? 0 if auto answer is disabled; 1 if auto answer is enabled

+FCLASS? 0 if in data mode; 1 if in fax class 1; 2 if in fax class 2

+F<command>=? - Report Operating Capabilities

+F<command>=? can be used to determine the operating capabilities of the modem.

Typical responses are:

+FAE=? 0 or 1

+FCLASS=? 0, 1, or 2

+FTM=? 24, 48, 72, 96 (9600 bps version)

+FRM=? 24, 48, 72, 96 (9600 bps version)

+FTM=? 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146 (14400 bps version)

+FRM=? 24, 48, 72, 73, 74, 96, 97, 98, 121, 122, 145, 146 (14400 bps version)

Data/Fax Auto Answer**AT +FAE=n**

+FAE=n allows the DTE to either restrict answering to class 1, or to automatically detect whether the calling station is a fax class 1 modem or data modem, and answer accordingly.

Parameters: n = 0 or 1

Command options:

- n = 0 Disable data/fax auto answer mode. The modem answers as a fax modem only. (Default).
- n = 1 Enable data/fax auto answer mode. The modem answers as a fax or data modem.

Stop Transmission and Wait**AT +FTS=n**

+FTS=n causes the modem to terminate a transmission and wait for n 10-ms intervals before responding with the OK result code. An ERROR response code results if this command is issued while the modem is on-hook.

Receive Silence**AT +FRS=n**

+FRS=n causes the modem to report back to the DTE with an OK result code after n 10 ms-intervals of silence have been detected on the line. This command is aborted if any character is received from the DTE. The modem discards the aborting character and issues an OK result code. An ERROR response code results if this command is issued while the modem is on-hook.

Transmit Data**AT +FTM=n**

+FTM=n causes the modem to transmit data using the modulation defined below. An ERROR response code results if this command is issued while the modem is on-hook.

Parameters: See Command options

Command options:

+FTM=24	V.27 ter 2400 bps
+FTM=48	V.27 ter 4800 bps
+FTM=72	V.29 7200 bps
+FTM=73	V.17 7200 bps long
+FTM=74	V.17 7200 bps short
+FTM=96	V.29 9600 bps
+FTM=97	V.17 9600 bps long
+FTM=98	V.17 9600 bps short
+FTM=121	V.17 12000 bps long
+FTM=122	V.17 12000 bps short
+FTM=145	V.17 14400 bps long
+FTM=146	V.17 14400 bps short

Receive Data**AT +FRM=n**

+FRM=n causes the modem to enter the receiver mode using the modulation defined below. An ERROR response code results if this command is issued while the modem is on-hook.

Parameters: See Command options

Command options:

+FRM=24	V.27 ter 2400 bps
+FRM=48	V.27 ter 4800 bps
+FRM=72	V.29 7200 bps
+FRM=73	V.17 7200 bps long
+FRM=74	V.17 7200 bps short
+FRM=96	V.29 9600 bps
+FRM=97	V.17 9600 bps long
+FRM=98	V.17 9600 bps short
+FRM=121	V.17 12000 bps long
+FRM=122	V.17 12000 bps short
+FRM=145	V.17 14400 bps long
+FRM=146	V.17 14400 bps short

Transmit Data with HDLC Framing**AT +FTH=n**

+FTH=n causes the modem to transmit data using HDLC protocol and the modulation defined below. An ERROR response code results if this command is issued while the modem is on-hook.

Parameters: See Command options.

Command options:

+FTH=3	V.21 channel 2 300 bps
+FTH=24	V.27 ter 2400 bps
+FTH=48	V.27 ter 4800 bps
+FTH=72	V.29 7200 bps
+FTH=73	V.17 7200 bps long
+FTH=74	V.17 7200 bps short
+FTH=96	V.29 9600 bps
+FTH=97	V.17 9600 bps long
+FTH=98	V.17 9600 bps short
+FTH=121	V.17 12000 bps long
+FTH=122	V.17 12000 bps short
+FTH=145	V.17 14400 bps long
+FTH=146	V.17 14400 bps short

Receive Data with HDLC Framing**AT +FRH=n**

+FRH=n causes the modem to receive frames using HDLC protocol and the modulation defined below. An ERROR response code results if this command is issued while the modem is on-hook.

Parameters: See Command options.

Command options:

+FTH=3	V.21 channel 2 300 bps
+FRH=24	V.27 ter 2400 bps
+FRH=48	V.27 ter 4800 bps
+FRH=72	V.29 7200 bps
+FRH=73	V.17 7200 bps long

+FRH=74	V.17 7200 bps short
+FRH=96	V.29 9600 bps
+FRH=97	V.17 9600 bps long
+FRH=98	V.17 9600 bps short
+FRH=121	V.17 12000 bps long
+FRH=122	V.17 12000 bps short
+FRH=145	V.17 14400 bps long
+FRH=146	V.17 14400 bps short

3.3.3 Examples.

Examples of calling (transmitting) and answering (receiving) one page using fax class 1 commands are shown in Tables 2 and 3, respectively.

Table 2 Fax Class 1 Calling Sequence (One Page)

DTE Commands (Host)	DCE Responses (Modem)	Remote Fax	Notes
(1) AT+FCLASS=1	(2) OK		Set to Class 1
PHASE A			
(3) ATDT6163	(4) dials	(5) answers	+FRH=3 implied by Dialling
PHASE B			
	(6) CONNECT	(7) Send HDLC flags	
	(9) <NSF>, OK	(8)	Send NSF frame
(10) AT+FRH=3	(11) CONNECT	(12) Send CSI frame	
(14) AT+FRH=3	(13) <CSI>, OK	(16) Send DIS frame	Last frame bit = 1
	(15) CONNECT	(18) drop carrier	
(19) AT+FTH=3	(17) <DIS>, OK	(21) Receive flags	
	(20) send HDLC flags	(21) Receive flags	
	(21) CONNECT	(24) Receive TSI	last frame bit = 0
(22) <TSI>	(23) send TSI frame	(28) Receive DCS	last frame bit = 1
	(25) CONNECT		
(26) <DCS>	(27) send DCS frame		
	(29) detect last frame bit		
	(39) OK, drop carrier		
(31) AT+FTS=8	(32) OK, wait 80 ms		
(33) AT+FTM=96	(34) send V.29		
	(35) CONNECT		
(36) <TCF>	(37) send TCF data	(38) Receive & check	
	(39) OK		
(40) AT+FRH=3	(41) CONNECT		last frame bit = 1
	(42) send CFR frame		
(43) <CFR>, OK	(44) drop carrier		
	(45) OK		
PHASE C			
(46) AT+FTM=96	(47) send V.29		
	(48) CONNECT		
(49) age data	(50) send page data	(51) receive data	
	(52) OK		
(53) AT+FTH=3	(54) send HDLC flags	(55) receive flags	
	(56) CONNECT		
PHASE D			
(57) <EOP>	(58) send EOP frame	(59) receive EOP	last frame bit = 1
	(60) OK, drop carrier		
(61) AT+FRH=3	(62) CONNECT	(63) send MCF frame	last frame bit = 1
	(64) <MCF>, OK		
(65) AT+FTH=3	(66) send HDLC flags	(67) receive flags	
	(68) CONNECT		
(69) <DCN>	(70) send DCN frame	(71) receive DCN	last frame bit = 1
	(72) OK, drop carrier		
PHASE E			
(73) ATH0	(74) OK, hang up	(75) hang up	

Table 3 Fax Class 1 Answering Sequence (One Page)

DTE Commands (Host)	DCE Responses (Modem)	Remote Fax	Notes
(1) AT+FCLASS=1	(2) OK		Set to Class 1
PHASE A			
		(3) FAX machine dials	
(5) ATA	(4) RING		
	(6) modem answers		
	(7) Send HDLC flags	(8) Receive flags	+FTH=3 implied by answering
	(9) CONNECT		
PHASE B			
(10) <NSF>	(11) send NSF frame	(12) Receive NSF	last frame bit = 0
	(13) CONNECT		
(14) <CSI>	(15) send CSI frame	(16) Receive CSI	last frame bit = 0
	(17) CONNECT		
(18) <DIS>	(19) send DIS frame	(20) Receive DIS	last frame bit = 1
	(21) OK, drop carrier		
(22) AT+FRH=3	(23) CONNECT		
	(25) <TSI>, OK	(24) Send TSI frame	last frame bit = 0
(26) AT+FRH=3	(27) CONNECT		
	(29) <DCS>, OK	(28) Send DCS frame	last frame bit = 1
(31) AT+FRM=96		(30) Drop Carrier	
	(33) CONNECT	(32) Send V.29	
	(35) <TCF>	(34) Send TCF frame	
	(37) NO CARRIER	(36) Drop carrier	
(38) AT+FTH=3	(39) CONNECT		
(40) <CFR>	(41) Send CFR frame	(42) Receive CFR	last frame bit = 1
	(43) OK, drop carrier		
PHASE C			
(44) AT+FRM=96		(45) Send page data	
	(46) <page data>	(47) Drop carrier	
	(48) NO CARRIER		
PHASE D			
(49) AT+FRH=3	(50) CONNECT		
	(52) <EOP>, OK	(51) Send EOP frame	last frame bit = 1
	(54) CONNECT		
(53) AT+FTH=3	(56) Send MCF frame	(57) Receive MCF	last frame bit = 1
	(58) OK, drop carrier		
(59) AT+FRH=3	(60) CONNECT		
	(62) <DCN>, OK	(61) Send DCN frame	last frame bit = 1
PHASE E			
(73) ATH0	(74) OK, hang up	(75) hang up	

3.4 Fax Class 2 Commands.

The fax class 2 commands are summarized in Table 4.

3.4.1 Command Syntax and Guidelines.

3.4.1.1 DTE Commands.

The ISO 646 character set (CCITT T.50 International Alphabet 5, American Standard Code for Information Interchange) is used for the issuance of commands and responses. Only the low-order 7 bits of each character are used for commands or parameters; the high order bit is ignored. Upper case characters are equivalent to lower case characters. For Phase C data transmission or reception, all 8 bits are needed.

DTE Command Lines

A command line is a string of characters sent from a DTE to the DCE while the DCE is in a command state. Command lines have a prefix, a body, and a terminator. The prefix consists of the ASCII characters "AT" (065, 084) or "at" (097, 116). The body is a string of commands restricted to printable ASCII characters (032 - 126). Space characters (ASCII 032) and control characters other than CR (ASCII 013) and BS (ASCII 010) in the command string are ignored. The default terminator is the ASCII <CR> character. Characters that precede the AT prefix are ignored.

Basic Command Syntax

Characters within the command line are parsed as commands with associated parameter values. The basic commands consist of single ASCII characters, or single characters preceded by a prefix character (e.g., "&"), followed by a decimal parameter. Missing decimal parameters are evaluated as 0.

Extended Command Syntax

The facsimile commands use extended syntax. They are preceded by the "+F" characters, and they are terminated by the semicolon ";" character (ASCII 059) or by the <CR> that terminated the command line.

AT+FAE=0 ; +FCR 1 <CR>

This command instructs the DCE to automatically answer a data or fax call and also enables reception.

AT+FCLASS=0 <CR> for Data Mode
 AT+FCLASS=1 <CR> for Service Class 1 Fax
 +FCLASS=2 <CR> for Service Class 2 Fax

In Class 2, the DCE makes and terminates calls, manages the communication session and negotiates (T.30 protocol) and transports the image data to DTE. The T.4 protocol management of image data, etc., is done by DTE.

The response to

AT+FCLASS= 0<CR> in Data Mode
 or
 AT+FCLASS=2<CR> in Service Class 2 Fax
 is
 OK

The service class may be set by the DTE from the choices available using the "+FCLASS=<VALUE>" command.

General Rules

1. +Fnnn commands must be entered completely, otherwise an ERROR response is sent.
2. All response messages are preceded and followed by <CR><LF>. Multiple response commands (e.g., +FDIS: +FCSI: and +FDCS:) will, therefore, appear to have a blank line between them.
3. Fax Class 2 commands can be separated by the ";" character. The ";" character can be omitted if desired. Note that non-data commands cannot be separated by the ";" which is allowed as a dial modifier.

Table 4 Fax Class 2 Commands

Command	Function
Service Class ID	
+FCLASS=	Service Class
Class 2 Action Commands	
D	Originate a Call
A	Answer a Call
+FDT	Data Transmission
+FET=N	Transmit Page Punctuation
+FDR	Begin or Continue Phase C Receive
+FK	Session Termination
Class 2 DCE Responses	
+FCON	Facsimile Connection Response
+FDCS:	Report Current Session
+FDIS:	Report Remote Identification
+FCFR	Indicate Confirmation to Receive
+FTSI:	Report the Transmit Station ID
+FCSI:	Report the Called Station ID
+FPTS:	Page Transfer Status
+FET:	Post Page Message Response
+FHNG	Call Termination with Status
Class 2 Session Parameters	
+FMFR?	Identify Manufacturer
+FMDL?	Identify Model
+FREVP?	Identify Revision
+FDCC=	DCE Capabilities Parameters
+FDIS=	Current Sessions Parameters
+FDCS=	Current Session Results
+FLID=	Local ID String
+FCR	Capability to Receive
+FPTS=	Page Transfer Status
+FCR	Capability to Receive
+FAA	Adaptive Answer
+FBUF?	Buffer Size (Read Only)
+FPHCTO	Phase C Time Out
+FAXERR	Fax Error Value
+FBOR	Phase C Data Bit Order

4. All Class 2 commands are assumed to be the final command on a command line. Additional characters will be ignored.
5. An ERROR message will be generated if any of the following conditions:
 - a. A Class 1 command is received while in Class 2.
 - b. A Class 2 command is received while in Class 1.
 - c. A Class 1 or Class 2 action command is received while in data modem mode.
 - d. A Class 2 read-only parameter is given the "=" form of a +F command (e.g., AT+FAXERR=5).
 - e. A Class 2 action command is given the inappropriate "=" or "?" form (e.g., AT+FDR=?).

3.4.1.2 Serial Port Speed and Flow Control

During fax mode, the DTE-DCE port speed is 19200 bps.

The DCE provides a speed buffer of 1024 bytes and provides the DC1/DC3 (XON/XOFF) or RTS/CTS method of controlling the data into the buffer. This flow control is controlled by the &K3 or &K4 command.

This method of data flow control is available only for DTE to DCE direction of data. There is no provision for data flow control from DCE to DTE.

Data Stream Termination

The DCE exchanges streams of data with the DTE while executing data transfer commands. These data streams use the termination described in Section 3.2/ISO 2111.

The ASCII <DLE> character (016) is used as a special character to shield special characters. The <DLE><ETX> character pair (<106><003>) is used to mark the end of a stream. The following patterns are used:

any data...<DLE><ETX> end of stream

any data...<DLE><DLE> single <DLE> in data
any data...<DLE><any byte> delete <DLE><any byte>

DTE to DCE Streams

The DCE filters the data stream from the DTE, and removes all character pairs beginning with <DLE>. The DCE recognizes <DLE><ETX> as the stream terminator. The DCE recognizes <DLE><DLE> and reinserts a single <DLE> in its place.

The DTE must filter stream data to the DCE, and insert extra <DLE> characters ahead of data.

DCE to DTE Streams

The DTE must filter the data stream from the DCE, and remove all character pairs beginning with <DLE>. The DTE must recognize <DLE><ETX> as the stream terminator. The DTE must recognize <DLE><DLE> and reinsert a single <DLE> in its place.

The DCE filters stream data to the DTE, and inserts extra <DLE> characters ahead of data.

3.4.1.3 Auto Answer.

The DCE can answer as a data DCE or as a fax DCE. It can answer the call adaptively, i.e., it can determine whether call is 'data' or 'fax'. The +FAA parameter controls this feature.

AT+FAA=1 ; Auto answer as a facsimile or a data
 modem depending on the call

CONNECT XXXX ; DCE status response if data call

+FCON ; DCE status response if fax call

3.4.1.4 Identification of T.30 Options.

Group 3 devices negotiate session parameters in DIS, DCS, and DTC frames. These parameters are defined in Table 5.

3.4.1.5 Session Status Reporting.

The DCE provides reports to the DTE on the status of a session. The DCE provides following status reports:

1. Connection and hang up status:

+FCON

+FHNG:<0-255>
2. Requested DIS session parameters +FDIS: <string> reports remote facsimile capabilities.

Syntax: +FDIS: VR, BR, WD, LN, DF, EC, BF, ST
3. +FDCS: <string> reports the negotiated parameters
4. Phase C prompts:

XON, XOFF, DC2
5. Phase C base status reports: depending upon copy quality and related end-of page status:

+FPTS: <1-5>

3.4.1.6 Procedure Interrupt Negotiation.

CCITT allows a station to request a procedure interruption at the end of a page. This request is passed between stations by the PIP, PIN and PRI-Q messages.

3.4.2 Service Class 2 Identification and Selection.

Three commands report identification and selection information. Each of these three commands cause the DCE to send a message to the DTE.

Request Manufacturer Identification**AT +FMFR?**

The +FMFR? command causes the DCE to send a message identifying the DCE product manufacturer. The message is:

LASAT COMMUNICATIONS A/S
OK

Identify Product Model**AT +FMDL?**

The +FMDL? command causes the DCE to send a message identifying the DCE product model. The message is similar to:

LASAT unique 144
OK

Identify Product Revision**AT +FREV?**

The +FREV? command causes the DCE to send a message identifying the DCE product model revision number. The message is similar to:

unique 144 V1.30DK
OK

3.4.3 Service Class 2 Action Commands.

These commands transfer data, and punctuate sessions. They also release specific T.30 messages. All action commands must be the last command on a command line as indicated by the terminating <CR>.

All action commands initiate processes. The modem will not accept other commands from the DTE until the modem issues a final result code (e.g., OK, CONNECT). The modem will abort the process if it receives any character before the final result code is issued.

Originate a Call**AT D**

Syntax: ATD....<CR>

The DCE can support a DTE command to originate a call using the ATD command (see Section 3.3.2).

If this command is unsuccessful, the DCE reports an appropriate failure or error type result code such as NO CARRIER, NO DIALTONE, or BUSY (see Section 3.3.3).

If this call is successful, the typical DCE response is:

ATDnn..nn (go off-hook, dial, get CED)
+FCON (DCE detects flags)
[+FCSI:<remote ID string>]
+FDSC:<T.30 subparameter string>
OK

The DCE dials, detects call progress, and generates the CNG tone. It then waits for a DIS frame. On detection of the first Phase B preamble (V.21 ch. 2 modulated by 300 bps HDLC flags), it reports the "+FCON" message to the DTE. The DCE then switches to 19200 bps.

The DCE generates a DCS frame based on the received DIS frame and on the previously set +FDIS parameter. A +FDT command from the DTE releases the DCE to transmit that DCS frame.

The DCE reports the initial received T.30 negotiation messages, including the DIS frame and the optional CSI ID string. The +FDIS: report is followed by the OK final result code.

Answer a Call**AT A**

The DCE can support a DTE command to answer an incoming call using the ATA command (see Section 3.3.2).

The DTE may issue an Answer command in response to an incoming ring.

If the Answer command is unsuccessful, the DCE will report an

appropriate failure or error type result code, such as NO CARRIER (see Section 3.3.3).

Manual Call Answer

If this call is successful, the typical DCE response (answer and receive) is:

```
+FCON
[+FTSI:<remote ID string>]
+FDSCS:<T.30 subparameter string>
OK
(DTE should issue +FDR command here)
```

Upon receipt of an Answer command from the DTE, the DCE answers and generates the CED tone. The DCE then generates a DIS frame (derived from the +FDIS parameter) and hunts for the first T.30 negotiation frames. On detection of the first Phase B preamble (V.21 ch 2 modulated by 300 bps HDLC flags), it reports the "+FCON" message to the DTE.

The DTE should report the initial received T.30 negotiation messages, including the DCS frame. The +FDSCS: report will be followed by the OK final result code.

Automatic Answer

The modem provides for automatic answering of incoming calls. If configured for automatic answer, the modem answers an incoming call in compliance with T.30, and reports the same messages as described for manual answer.

Connection as a Data Modem

If configured to do so by the +FAA parameter, the DCE will adaptively answer as a facsimile DCE or as a data DCE. If the DCE answers as a data DCE, it resets the +FCLASS parameter to 0 and issues the appropriate final result code (e.g., CONNECT, or NO CARRIER) to the DTE.

Data Transmission

AT +FDT Syntax: +FDT <CR>

The +FDT command prefixes Phase C data transmission. When the DCE is ready to accept Phase C data, it issues the negotiation responses and the CONNECT result code to the DTE.

In Phase B, the +FDT command releases the DCE to proceed with negotiation, and releases the DCS message to the remote station. In Phase C, the +FDT command resumes transmission after the end of a prior transmit data stream.

Initiate Page Transmission

Phase B DCE polled response:

```
[+FCFI:<remote ID string>] - if new CSI received
[+FDIS:<subparameters from remote station>] - if new DIS
received
+FDSCS:<T.30 subparameter string>
CONNECT
<XON> - when ready for data
```

After placing a call, or after finishing a document exchange, the DTE may command the DCE to re-enter T.30 Phase B to attempt to negotiate a document transmission.

Continue a Page

```
CONNECT
<XON>
```

The DTE may issue more than one +FDT command for a given page, so that different files may be concatenated together. These files must have the same format.

Phase C Data Framing

Phase C data must be presented to the DCE in stream mode. The DCE expects Phase C data to follow until it detects <DLE><ETX> termination characters. The DCE will filter the stream as described in Section 3.4.1.2.

The DCE will acknowledge the end of the data by returning the OK result code to the DTE.

If there is data underrun before the next +FDT or +FET= command, the DCE will zero-fill the pad as per T.4 until the Phase C timeout (+FPHCTO) is reached, or until more data is received. The DCE appends an RTC pattern to the transmit data after an +FET= command is received from the DTE.

Phase C Data Format

The Phase C data will be of the format specified by the negotiated T.30 DCS frame. The +FDSCS:<string> response is defined in Section 3.4.4. The subparameter values are described in Table 5.

The DCE will use the negotiated minimum Scan Time parameter from the DCS frame, and insert sufficient fill bits to pad each line to the minimum scan time. This is reported in the +FDSCS:ST subparameter.

If the DCE finds more than one consecutive EOL in Phase C data (e.g., RTC), it will send only one EOL.

1. Phase C data must conform to T.4 specifications.
2. The DTE need not include a final RTC, since the DCE will append an RTC in response to an FET= command.
3. Some facsimile machines may treat two EOLs as an RTC.

<CAN>, Escape from Transmission

The DCE may request the DTE to halt Phase C transmission, by sending a cancel <CAN> character (024) to the DTE. In this case, the DTE should terminate Phase C transmission, issue <CAN>, and wait for the OK response code from the DCE.

Table 5 T.30 Session Subparameter Codes

Label	Function	Value	Description
VR	Vertical Resolution	0	Normal, 98 lpi
		1	Fine, 196 lpi
BR	Bit Rate (See Note 1)	0	2400 bps V.27 ter
		1	4800 bps V.27 ter
		2	7200 bps V.29 or V.17
		3	9600 bps V.29 or V.17
		4**	12000 bps V.33 or V.17
		5**	14400 bps V.33 or V.17
WD	Page Width	0	1728 pixels in 215 mm
		1	2048 pixels in 255 mm
		2	2432 pixels in 303 mm
		3*	1216 pixels in 151 mm
		4*	864 pixels in 107 mm
LN	Page Length	0	A4, 297 mm
		*1	B4, 364 mm
		*2	unlimited length
DF	Data Compression Format	0	1-D modified Huffman
		1	2-D modified Read
		2*	2-D uncompressed mode
		3*	2-D modified Read
EC	Error Correction (Annex A/T 30)	0	Disable ECM
		1	Enable ECM, 64 bytes/frame
		2*	Enable ECM, 256 bytes/frame
BF	Binary File Transfer	0	Disable BFT
		1*	Enable BFT
	Scan Time/Line		VR = normal VR = fine
		0	0 ms 0 ms
		1	5 ms 5 ms
		2	10 ms 5 ms
		3	10 ms 10 ms
		4	20 ms 10 ms
		5	20 ms 20 ms
		6	40 ms 20 ms
		7	40 ms 40 ms

Notes: 1. CCITT.30 does not provide for the answering station to specify all speeds exactly using the DIS frame. Implementation of some BR codes (e.g., code 2) by an answering DCE is manufacturer specific.

* Not supported.

** Available only if modem supports 12000 and 14400 bps.

Transmit Page Punctuation

AT +FET Syntax: +FET=<ppm>[,<pc>,<bc>,<fc>]

DCE response:

+FPTS:<ppr> - when receive from remote OK

This command is used to punctuate page and document transmission after one or more +FDT commands. This command generates T.30 Post Page Messages selected by the <ppm> code (Table 6).

The +FET=<ppm> command indicates that the current page is complete; no more data will be appended to it. The value indicates if there are any additional pages are to be sent and, if so, whether there is a change in any of the document parameters.

The DTE can command the DCE to generate PRI-Q messages with the +FET=<ppm> command using ppm codes 4-6 (see Table 6).

This command must be sent within the time out specified by +FPHCTO after sending Phase C data, or else the DCE will end the page and document transmission. If the Phase C timeout is reached, the DCE sends an EOP post page message and terminates the session.

The remote facsimile station should respond to the post page message with a post page response. The DCE will report this using the +FPTS:<ppr> response (Table 7).

End a Page

The +FET= command causes the DCE to append an RTC (6 EOL) pattern as needed and enter Phase D by sending the selected T.30 Post Page message.

The +FET=1 (EOM) command signals the remote station that the next document will have a new DCS negotiated; this causes the session to re-enter Phase B.

Table 6 T.30 Post Page Message Codes

ppm Code	Mnemonic	Description
0	[PPS]-JMPS	Another page next, same document
1	[PPS]-JEOM	Another document next
2	[PPS]-JEOP	No more pages or documents
3	PPS-NULL	Another partial page next
4	[PPS]-PRI-MPS	Another page, procedure interrupt
5	[PPS]-PRI-EOM	Another doc., procedure interrupt
6	[PPS]-JEOP	All done, procedure interrupt
=8+ppm		Post Page Message (ppm code)

Table 7 T.30 Post Page Response Messages

ppr Code	Mnemonic	Description
1	MCF	Page good
2	RTN	Page bad; retrain requested
3	RTP	Page good; retrain requested
4	PIN	Page bad; interrupt requested
5	PIP	Page good; interrupt requested

Begin or Continue Phase C Receive Data

AT +FDR Syntax: +FDR <CR>

Default value: 3 seconds in some places

The +FDR command initiates transition to Phase C data reception. This can occur after answering, dialling, a document is received, or a page is received.

The DCE reports the negotiated T.30 parameters, with the remote ID information if available. When the DCE is ready to commence data transfer, it issues a CONNECT response code. If the DCE cannot resume data transfer because there is no more data, it responds OK. When the DTE is ready to accept data, it issues an <DC2> character (018) to the DCE.

If the DTE issues an <XOFF> character to the DCE for flow control, the DCE signals the DTE when its buffers are empty by sending a <DLE><DC2> (<016><018>) character pair.

When the DCE delivers that last byte of a page, the DCE reports the Page Transfer Status via the +FPTS:<ppr> response (Table 7).

After a Page Transfer Status Report, the DCE reports the post page message from the remote facsimile station via the +FET:<ppm> response (Table 6) which signals the intentions of the remote station.

The DCE holds the post page response message to the remote facsimile station (MCF, etc.), represented in the +FPTS parameter until the next +FDR command. The DTE may modify the +FPTS parameter before issuing the +FDR command which releases that message. The DTE must issue a +FDR command to release Post Page Messages.

Initiate Document Reception

The +FDR command may be issued in Phase B after an answer command, or in Phase B after a previous document.

The DCE response in stream mode is:

```
+FCFR - when CFR sent
[+FTSI:<remote ID string>] - if new TSI received
+FDCS:<T.30 subparameter string>] - if new DCS
CONNECT
(<DC2> needed from DTE here)
<Phase C data stream>
<DLE><ETX>
+FPTS:<ppr>, <lc> [,<blc>, <cbic>]
+FET:<ppm>
OK
(DTE must issue +FDR command to release post page response)
```

Continue Document Reception

The DTE may issue a +FDR command in Phase D, which releases the post page message, and indicates readiness to receive another page after receipt of a Multipage (+FET:0) or PPS-NULL (+FET:3) message. The DCE response will be:

CONNECT

```
(<DC2> needed from DTE here)
<Phase C data stream>
<DLE><ETX>
+FPTS:<ppr>, <lc> [,<blc>, <cbic>]
+FET:<ppm>
OK
(DTE must issue +FDR command to release post page response)
```

If done receiving:

```
+FHNG: <hangup cause code>
OK
```

Continue page reception

Phase C Data Framing

Phase C data may be presented to the DTE in stream mode. The DCE will transfer a stream of data to the DTE, followed by the <DLE><ETX> stream termination characters. The DCE will filter the stream as described in 3.4.1.2.

Phase C Data Format

The received data format is negotiated under T.30 reported by the +FDCS:VR,BR,WD,LN,DF,EC,BF,ST response.

The DCE will delete the terminating RTC (6 EOLs) patterns.

<CAN>, Escape from Reception

From the +FDR command until the end of Phase D Date, the DCE is in a data transfer state, and will not respond to DTE command characters. The DCE will respond to three ASCII control characters: <DC1> (017) and <DC3> (019) flow control characters, and cancel <CAN> (024).

Upon receipt of the <CAN> character, the DCE will terminate the reporting of received data by sending trailing <DLE><ETX> characters to the DTE, and will then execute an implied +FK command in order to conduct an orderly disconnection.

Session Termination**AT +FK** Syntax: +FK

The +FK command causes the DCE to terminate the session in an orderly manner. In particular, the DCE will send a DCN message at the next opportunity and hang up. At the end of the termination process, the DCE will report the +FHNG response with result code (Table 8).

This operation can be invoked by using the cancel <CAN> character during Phase C data reception (see prior section)

The DCE will wait until the current page completes, unless the reception is of unlimited length; in that case, the DCE may halt reception and terminate the session at any time.

Table 8 Hang Up Status Codes

Code	Cause Description
0-9	Call Placement and Termination
0	Normal and proper end of connection
1	Ring Detect without successful handshake
2	Call aborted, from +FK or AN
3	No Loop Current
10-19	Transmit Phase A & Miscellaneous Errors
10	Unspecified Phase A error
11	No Answer (T30 T1 timeout)
20-39	Transmit Phase B Hangup Codes
20	Unspecified Transmit Phase B error
21	Remote cannot receive or send
22	COMREC error in transmit Phase B
23	COMREC invalid command received
24	RSPEC error
25	DCS sent three times without response
26	DIS/TTT received 3 times; DCS not recognized
27	Failure to train at 2400 bps or +FMINSF value
28	RSPEC invalid response received
40-49	Transmit Phase C Hangup Codes
40	Unspecified Transmit Phase C error
43	DTE to DCE data underflow
50-69	Transmit Phase D Hangup Codes
50	Unspecified Transmit Phase D error
51	RSPEC error
52	No response to MPS repeated 3 times
53	Invalid response to MPS
54	No response to EOP repeated 3 times
55	Invalid response to EOP
56	No response to EOM repeated 3 times
57	Invalid response to EOM
58	Unable to continue after PIN or PIP
70-89	Receive Phase B Hangup Codes
70	Unspecified Receive Phase B error
71	RSPEC error
72	COMREC error
73	T.30 T2 timeout, expected page not received
74	T.30 T1 timeout after EOM received
90-99	Receive Phase C Hangup Codes
90	Unspecified Receive Phase C error
91	Missing EOL after 5 seconds
92	Unused code
93	DCE to DTE buffer overflow
94	Bad CRC or frame (ECM or BFT modes)
100-119	Receive Phase D Hangup Codes
100	Unspecified Receive Phase D errors
101	RSPEC invalid response received
102	COMREC invalid response received
103	Unable to continue after PIN or PIP
120-255	Reserved Codes

Note: Some codes are not implemented

3.4.4 Service Class 2 DCE Responses.

The DCE sends information responses to the DTE as a facsimile session proceeds. They indicate the state of the facsimile session and convey needed information. These messages are solicited messages generated in execution of DTE action commands described in Section 3.4.3.

The DCE precedes and follows the following information responses with <CR><LF>.

The DCE provides the on-line status of several session parameters when they are available during T.30 handshaking. These include the remote ID string and the DIS/DCS parameters. These responses report the T.30 session parameter frames. The subparameters are described in Table 5.

Facsimile Connection Response

AT +FCON

+FCON indicates connection with a fax machine. It is released by detection of HDLC flags in the first received frame. +FCON is generated in response to an Originate or Answer command.

Report Current Session Capabilities

AT +FDCS:

Syntax: +FDCS:VR,BR,WD,LN,DF,EC,BF,ST

+FDCS:<string> reports the negotiated parameters. Phase C data will be formatted as described by the subparameters. This message may be generated in execution of +FDT or +FDR commands before the CONNECT result code if new DCS frames are generated or received. (See Table 5.)

Report Remote Station Capabilities

AT +FDIS:

Syntax: +FDIS:VR,BR,WD,LN,DF,EC,BF,ST

+FDIS:<string> reports remote facsimile station capabilities and intentions. The parameters are provided in ASCII notation (See Table

5).

This message is generated in execution of Originate, Answer, +FDT, or +FDR commands.

Indicate Confirmation to Receive

AT +FCFR

Syntax: +FCFR

The DCE sends a +FCFR response to the DTE upon reception of an acceptable TCF training burst and a valid DCS signal from the remote machine. This indicates that the DCE will receive Phase C data after the remote station receives the local DCE's CFR message. The +FCFR message is generated in execution of a +FDR command.

Report the Transmit Station ID

AT +FTSI:

Syntax: +FTSI: "<TSI ID string>" Transmit Station ID

This response reports the received transmit station ID string, if any. This message is generated in execution of Originate, Answer, +FDT, or +FDR commands.

Report the Called Station ID

AT +FCSI:

Syntax: +FCSI: "<CSI ID string>" Called Station ID

This response reports the received called station ID string, if any. This message is generated in execution of Originate, Answer, +FDT, or +FDR commands.

Receive Page Transfer Status

AT +FPTS:

Syntax: +FPTS:<ppr>, <lc> [,<blc>, <cbic>]

The +FPTS:<ppr> is generated by the DCE at the end of Phase C data

reception in execution of a +FDR command.

The <ppr> is generated by the DCE; it depends on the DCE capabilities at T.4 error checking. See Table 7 for <ppr> values.

The receiving DCE will count the lines. These values are;

<lc> = line count
 <blc> = bad line count
 <cbcl> = <consecutive bad line count

A receiving DTE may inspect <ppr> and write a modified value into the +FPTS parameter. The DCE will hold the corresponding Post Page Response message until released by a +FDR command from the DTE.

Post Page Message Response

AT +FET: Syntax: +FET:<ppm>

The +FET:<post page message> response is generated by a receiving DCE after the end of Phase C reception on receipt of the post-page message from the transmitting station. The +FET:<ppm> response is generated in execution of a +FDR command. The <ppm> codes respond to the T.30 post page messages (Table 6).

Transmit Page Transfer Status

AT +FPTS:

Syntax: +FPTS:<ppr>

The +FPTS: response reports a <ppr> number representing the copy quality and related post-page message responses received from the remote DCE. The set of valid <ppr> values are defined in Table 7.

The +FPTS:<ppr> response is generated in execution of a +FET=<ppm> command.

Call Termination with Status

AT +FHNG:

Syntax: +FHNG:<hangup status code>

+FHNG indicates that the call has been terminated. The hangup cause is reported and stored in the +FAXERR parameter for later inspection. The <hangup status code> values are described in Table 8.

+FHNG:<hsc> is a possible intermediate result code to any DTE action command described in Section 3.4.3. It is always followed by the OK final result code.

Upon termination of a call, the DCE determines the cause of termination and reports it as part of the FHNG:<hsc> response. It also stores this <hsc> code in the +FAXERR parameter for later inspection.

The hangup values are organized according to the phases of the facsimile transaction as defined by T.30. In the Figure A/T.30 flow charts, there are decision boxes labelled "Command Received?"; this is referred to as COMREC in the table. Similarly, decision boxes labelled "Response Received?" are referred to as RSPREC in the table. A COMREC error or RSPREC error indicates that one of two events occurred: 1) a DCN (disconnect) signal was received, or 2) an FCS error was detected and the incoming signal was still present after 3 seconds. (See Figure A/T.30).

The table values are in decimal notation. Leading zero characters are optional.

3.4.5 Service Class 2 Parameters.

All Service Class 2 parameters can be read, written, and tested for range of legal values by the DCE. The general syntax is described in Section 3.4.1.

Group 3 FAX devices negotiate session parameters in DIS, DCS, and DTC frames. The following parameters are provided to condition the facsimile DCE for the capabilities it will offer and to report the session settings negotiated.

The three primary T.30 session parameters are +FDCC, +FDIS and +FDCS. They are compound parameters, using values listed in Table 5. Figure 1 illustrates their relationships.

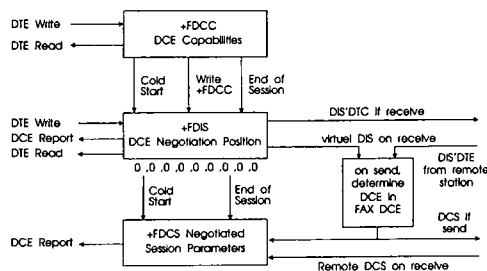


Figure 1 T.30 Session Parameter Relationships

DCE Capabilities Parameters

AT +FDCC

Write syntax: +FDCC=VR,BR,WD,LN,DF,ED,BF,ST

Valid values: See Table 5

Default values: 0,3,0,2,0,0,0,0 (9600 bps version)

0,5,0,2,0,0,0,0 (14400 bps version)

+FDCC allows the DTE to sense and constrain the capabilities of the facsimile DCE from the choices defined in CCITT T.30 Table 2. When +FDCC is modified by the DTE, the DCE copies +FDCC into +FDIS.

Current Sessions Capabilities Parameters

AT +FDIS Write syntax: +FDIS=VR,BR,WD,LN,DF,EC,BF,ST

Valid values: See Table 5

3. Command Sets.

Default values: 0,3,0,2,0,0,0,0 (9600 bps version)
0,5,0,2,0,0,0,0 (14400 bps version)

The +FDIS parameter allows the DTE to sense and constrain the capabilities used for the current session. The DCE uses +FDIS to generate DIS or DTC messages directly, and uses +FDIS and received DIS messages to generate DCS messages.

The DCE initializes the +FDIS parameter from the +FDCC parameter on initialization, when +FDCC is written, and at the end of a session.

Current Session Results Parameters

AT +FDCS

Read syntax: +FDCS?

DCE response: +FDCS=VR,BR,WD,LN,DF,EC,BF,ST

or +FDCS=

Valid values: See Table 5.

Default values: 0,0,0,0,0,0,0,0

The +FDCS parameter is loaded with the negotiated T.30 parameters for the current session. A transmitting DCE generates DCS; a receiving DCE gets DCS from the remote station. The DTE may read this parameter.

The +FDCS parameter is initialized 0,0,0,0,0,0,0,0 upon initialization, and at the beginning of a session. If the DTE issues a +FDCS? command in the initial state, the DCE reports:

<CR><LF>0,0,0,0,0,0,0,0<CR><LF>

The contents of +FDCS are spontaneously reported during execution of +FDR or +FDT commands by the +FDCS:VR,BR,WD,LN,BF,EC,BF,ST response using the same compound parameter format.

Several commands and responses reference T.30 session negotiated parameters. These are described by a set of common subparameters. These subparameters are described in Table 5 with notes. Optional parameter values are marked with an *. Unspecified parameter values

are reserved for future use.

The +FDCC, +FDIS, and +FDCS compound parameters use these session parameters. On writes, unspecified subparameters are unchanged.

The +FDIS:, +FDCS:, and +FDTC: session report responses use these subparameters.

For test response, ranges of values are reported for each subparameter enclosed in parentheses characters. For example, a DCE response to +FDCC=? could report:

```
<CRLF> (0,1), (0-3), (0-3), (0-2), (0-2), (0-2), (0), (0-7) <CRLF>
(9600 bps version)
```

or

```
<CRLF> (0,1), (0-5), (0-3), (0-2), (0-2), (0-2), (0), (0-7) <CRLF>
<N>(14400 bps version)
```

Example:

```
+FDIS=0,3,0,2,0,0,0,1 =
VR = 0  98 dpi vertical resolution,
BR = 3  9600 bit/s (9600 bps version),
BR = 5  14400 bit/s (14400 bps version),
WD = 0  1728 pixels,
LN = 2  unlimited length
DF = 0  1-D modified Huffman coding,
EC = 0  no ECM,
BF = 0  no BFT,
ST = 1  5 ms scan time.
```

Local ID String

AT +FLID=

Write syntax: +FLID="<local ID string>"
Valid value: 20-character ASCII string
Default value: Empty

If FLID is not a null string, it generates a TSI or CSI frame. Table

3/T.30 includes digits 0-9, "+" and space.

If the DCE supports use of Table 3/T.30 only, the response to a +FLID=? command is "(20) (32, 43, 48-57)." If the DCE supports printable ASCII <, the response is: "(20) (32-127)<CRLF>." The first "(20)" represents string length: the second (character values) field reports supported string values.

1. The string is saved in RAM.
2. Non-numeric characters are not filtered out.
3. The string is right justified.

Capability to Receive

AT +FCR Write syntax: +FCR=<value>

Valid values: 0 or 1

Default value: 0

+FCR=0 indicates that the DCE will not receive message data. This can be used when the DTE has insufficient storage. The DCE can send and can be polled for a file.

+FCR is sampled in CCITT T.30 Phase A and Phase D.

Page Transfer Status

AT +FPTS=

Write Syntax: +FPTS=<ppr>

Valid values: 1, 2, 3, 4, 5

Default value: 0

The +FPTS parameter contains a value representing the post page response, including copy quality and related end-of-page status. These values correspond to post page response messages defined in T.30. The

receiving DCE sets this parameter after it receives a page of Phase C data. The transmitting DCE sets this parameter with the status reported by the receiving station. The DTE may inspect or modify this parameter.

The set of <ppr> values is defined in Table 7. These values are also reported in the +FPTS response to the +FDR command.

Copy Quality Checking

AT +FCQ Write syntax: +FCQ=<value>

Valid values: 0

Default value: 0

This parameter controls Copy Quality checking by a receiving facsimile DCE.

The DCE returns +FCQ=0 which indicates the DCE does no quality checking. The DCE will generate Copy Quality OK (MCF) responses to complete pages, and set +FPTS=1.

DTE Phase C Response Time-out

AT +FPHCTO

Write syntax: +FPHCTO=<value>

Valid values: 0 - 255, 100 millisecond units.

Default value: 30

The +FPHCTO command determines how long the DCE will wait for a command after reaching the end of data when transmitting in Phase C. When this time-out is reached, the DCE assumes there are no more pages and no documents to send. It then sends the T.30 EOP response to the remote device.

T.30 Session Error Report

AT +FAXERR

Read syntax: +FAXERR= <table value>, read only

Valid values: 0 - 255, see Table 8 for meaning

This read-only parameter indicates the cause of the hangup. Table 8 shows the valid values for this parameter as well as the meaning of the each value. +FAXERR is set by the DCE at the conclusion of a fax session. The DCE resets +FAXERR to 0 at the beginning of Phase A off-hook time.

Data Bit Order

AT +FBOR

Write syntax: +FBOR=<value>

Valid values: 0 or 1

Default value: 0

This parameter controls the mapping between PSTN facsimile data and the DTE-DCE link. There are two choices:

Direct: The first bit transferred to each byte on the DTE-DCE link is the first bit transferred on the PSTN data carrier.

Reversed: The last bit transferred of each byte on the DTE-DCE link is the first bit transferred on the PSTN data carrier.

There are two data types to control:

This command controls Phase C data (T.4 encoded data) transferred during execution of +FDT or +FDR commands.

The following two codes are supported:

+FBOR=0 Selects direct bit order for Phase C data.

+FBOR=1 Selects reversed bit order for Phase C data.

Note that this parameter does not affect the bit order of control characters generated by the DCE.

Answer Parameter

AT +FAA Write syntax: +FAA=<value>

Valid values: 0 or 1

Default value: 0

+FAA=0 Constrains the DCE to answer as set by +FCLASS.

+FAA=1 Indicates that the DCE can answer and automatically determine whether to answer as a Class 2 facsimile DCE or as a data modem. If the DCE automatically switches, it modifies FCLASS appropriately.

Class 2 adaptive answer is implemented as follows:

First, a data mode handshake is attempted. If the DCE has been configured for autmode detection (using the ATN1 command), the DCE may try several protocols before terminating attempts to make a data mode connection. This can take as long as 6-8 seconds.

If the data mode connection attempt fails, a facsimile Class 2 connection is assumed. When a connection is made as a result of the adaptive answer, the DCE issues the DATA or FAX result code before the CONNECT or +FCON message to inform the DTE of the connection type. After making a Class 2 connection, the DCE stays on-line rather than going into the command mode as with a Class 1 connection.

Buffer Size

AT +FBUF?

Read syntax: +FBUF?

DCE response syntax: <bs>, <xoft>, <xont>, <bc>
where:

<bs> = total buffer size

<xoft> = XOFF threshold

<xcont> = XON threshold

<bc> = current buffer byte count

Example:

+FBUF?

512, 506, 500, 0

The +FBUF parameter allows the DTE to determine the characteristics of the DCE's data buffer. Data buffers are used for flow control. Use of the reported values allow the DTE to transfer data without provoking XOFF.

3.4.6 Example Sessions.

Tables 9 and 10 show the typical command and responses for sending and receiving two pages, respectively.

Table 9 Send Two Pages, 1-D, No Errors

DTE command	DCE Response	Local DTE Action	Remote Station Action
AT?CLASS=2	OK	Set Class 2	x
AT+FLID="<local ID>"	OK	Set local ID	
AT<dial string>	off hook, dial send CNG detect flags (get CSI) get DIS +FCON [+FDIS:"<csi>"] +FDIS:<dis codes> OK		answer, send [CED] [CSI] DIS
AT+FDT	+FDCS:<DCS codes> CONNECT <XON>	(send TSI) send DCS send TCF get CFT send CFR send carrier send page data	(get TSI) get DCS get TCF send CFR receive carrier receive page data
<1st page data> <DLE><ETX>	OK		
AT+FET=0	+FPTS:1 OK	send<N>RTC get MPS get MCF	get RTC get MPS get MCF
AT+FDI	CONNECT <XON>	Send carrier	receive carrier
<2nd page data> <DLE><ETX>	OK	send page data	receive page data
AT+FET=2	+FPTS:1 +FHNG:0 OK	send RTC send EOP get MCF send DCN hang up	get RTC send MCF get DCN hang up

Table 10 Receive Two Pages, 1-D Data, No Errors

DTE command	DCE Response	Local DTE Action	Remote Station Action
AT+FCR=1	OK	Enable reception	
AT+FLID="<local ID>"	OK	Set local ID	
	RING	Detect ring	Dials [send CNG]
ATA	off hook send CED send CSI send DIS detect flags (get TSI) get DCS begin TCF receive +FCON [+FTSI:"<tsl>"] +FDCS:<dis codes> OK		get CED get CSI get DIS send V.21 flags [send TSI] send DCS start TCF
AT+FDR	+FCFR [+FDCS:"<dcscodes>"] CONNECT	accept TCF send CFR	finish TCF get CFR
<DC2>	get page carrier get page data detect RTC get MPS <page data stream> <DLE><ETX> +FPTS:1,<lc> +FET:0 OK	send page carrier send page data send RTC drop carrier send MPS	
AT+FDR	CONNECT	send MCF get page carrier get page data	get MCF send page carrier send page data
<DC2>	<page data stream> <DLE><ETX> +FPTS:1,<lc> +FET:2 OK	detect RTC get EOP	send RTC drop carrier send EOP
AT+FDR	+FHNG:0 OK	send MCF get DCN	get MCF send DCN

4. Testing the Modem and the Telephone Line.

When communicating via a modem connection errors may occur. These errors may occur at different points in the connection, either in the remote modem, on the telephone line or in the local modem.

If these errors are damaging to the current communication it is recommended to locate the cause of the error so that a report can be made to the right place (the person responsible for the remote modem, the telephone company or the supplier of the local modem). The LASAT modem offers some test facilities which make it possible to locate the error.

The facilities offered make it possible to test the transmitter and receiver of the local modem and to test whether the telephone line and the remote modem are in order. Furthermore, it is possible for the remote modem to test whether the telephone line and the local modem are working correctly.

If the local or the remote modem fails in the test of its own transmitter/receiver the error can be located to the modem failing. A test of the connection to the failing modem indicates an error in either the modem or the line. If the test of the transmitter/receiver in both modems is error free, and if the test of the telephone line and the remote modem indicates errors on both modems it is likely that the error is to be located on the telephone line.

If the test of the telephone line and the remote modem only indicates error on one of the modems the error can be either on the telephone line or on the modem failing.

The following test is available:

- 1 Local analog loop (CCITT V.54 loop 3), (the modem returns all data to the terminal/computer). The test can be made manually or as a self-operating test, which would be the same as testing the originated transmitter/receiver of the modem.

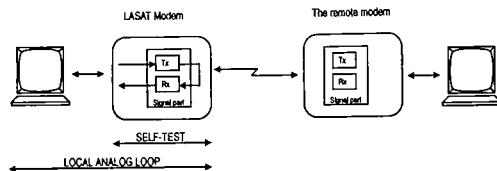


Fig. 4.1 Units involved in local analog loop (CCITT V.54 loop3).

- 2 Remote digital loop (CCITT V.54 remote loop 2) (the modem requests the remote modem to return all data to the telephone line). The test can be made manually or as a self-operating test which would be the same as testing the telephone line and the remote modem.

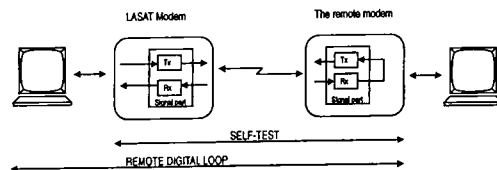


Fig. 4.2 Units involved in remote digital loop.

- 3 Digital loop (CCITT V.54 loop 2) returns all data received to the telephone line. Can be used if one of the modems used cannot use remote digital loop.

Furthermore, it is possible to accept or to refuse remote digital loop if the remote modem asks for this test.

Test can only be initiated by means of commands.

4.1 Termination of Test.

There are two ways of terminating an ongoing test. The duration of the test can be stated, and the test can be terminated by means of the AT command from the escape mode.

4.1.1 Limited Test.

AT command: **AT S18=XXX**

When a test time is chosen the test runs in the chosen number of seconds. Then the modem automatically returns to ordinary data mode.

4.1.2 Disconnection of Ongoing Test.

AT command: **AT &T0**

4.2 Local Test (CCITT V.54 loop 3).

Local analog loop is used for testing the connection between terminal and modem (see fig. 4.1). There are two ways of testing, one self-operating test and one where the test string is manually written and controlled on the computer.

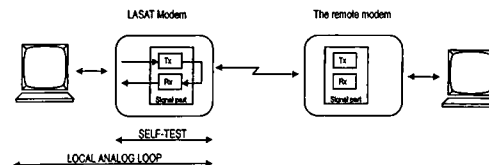


Fig. 4.3 Units involved in local analog loop (CCITT V.54 loop3).

4.2.1 Local Analog Loop

AT command: **AT &T1**

Local analog loop is used for testing the transmitting and receiving part of the modem. The modem collects all the data which are to be sent and returns them to its own receiving part. This means that everything entered in the terminal must be visualized on the display again.

Note:

If a connection to another modem has been established while initiating the test the connection will be disconnected.

If the local modem echoes the written text to the terminal, the local modem is in order.

Example 4.1:

Unlimited test time, the LASAT modem is in ordinary data mode.

Terminal: **AT &T1**
Initiate test.

Terminal: **Mary had a little lamb.**
Type any text.

Terminal: **+++**
Escape sequence.

Modem: **OK**
The modem is in the command mode.

Terminal: **AT &T0**
Terminate test.

4.2.2 Local Analog Loop with Self Test.

AT command: **AT &T8**

The test has the same function as local analog loop, and here the modem generates a text string which it uses for testing the transmitting and the receiving part. When the test is terminated a figure stating the number of bit errors occurred during the test is returned to the terminal. The test can be switched off manually or it can be limited.

If the modem has a connection to another modem when the test is initiated, the connection will be disconnected.

Example 4.2:

Local analog loop with test of sender/receiver, test for 2 minutes.

Terminal: **ATS18=120&T8**

After 2 minutes the test is disconnected automatically, and number and errors are shown on the terminal.

4.3 Remote Digital Loop (CCITT V.54 loop 2).

Remote digital loop controls the remote modem to return all the data received (data sent from the local modem) back on the telephone line (see fig. 4.2). In this way the data connection to the remote modem can be tested.

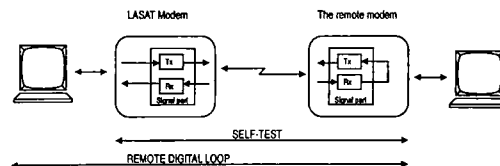


Fig. 4.4 Units involved in remote digital loop.

Note:

Remote digital loop can only be performed while a connection to another modem is upheld.

As this text implies that the remote modem can be requested to return data from the local modem, the test can only be performed with remote modems who are in possession of this facility.

4.3.1 Remote Digital Loop.

AT command: AT &T6

Remote digital loop is used for testing the remote modem and whether the telephone line is working correctly.

The LASAT modem requests the remote modem to return all data received via the modem connection. If the data sent are received correctly the error must be located between the remote modem and the computer connected to the remote modem.

Possible errors can be related to the remote modem, the telephone line connection or the LASAT modem.

In order to locate the cause of the error a test with local analog loop must be performed on the local as well as on the remote modem. If this does not result in an error reply the cause of the error must be on the telephone line.

Example 4.3:

Remote digital loop with manual disconnection, the modem is in the data mode.

Terminal: +++
Escape sequence.

Modem: OK
The modem is in the command mode.

Terminal: AT &T6
Terminate test.

If the test is in order, i.e. if the text received corresponds to the text sent, the computer, the local modem, the remote modem and the telephone connection are in order.

4.3.2 Remote Digital Loop with Self Test.

AT command: AT &T7

The test has the same function as the remote digital loop (AT&T6), but the modem generates a text string, which is used for testing the telephone line quality and the remote modem. When the test is terminated either as a limited test or manually a bit error rate is returned.

If the test is a bit error rate of 0, the local and remote modem and the telephone line are in order. Otherwise the local analog loop can be used for further investigation of the error.

Example 4.4:

Remote digital loop with test transmitter/receiver with limitation, the modem is in the data mode.

Terminal: +++
Escape sequence.

Modem: OK
The modem is in the command mode.

Terminal: ATS18=120 &T7
Terminate test.

After 2 minutes the test is disconnected automatically, and the number of errors are shown on the terminal.

4.4 Accept of Remote Digital Loop.

AT command: AT &T4

The command makes it possible for the modem to perform digital loop controlled from the remote modem.

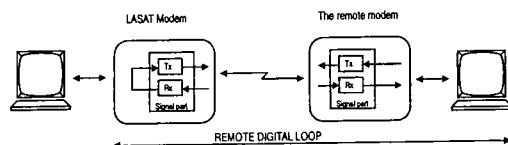


Fig. 4.5 Local modem accepts to perform digital loop.

4.5 Rejection of Remote Digital Loop.

AT command: **AT &T5**

The command makes it possible for the modem to reject digital loop controlled from the remote modem.

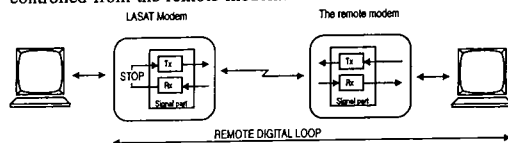


Fig. 4.6 Rejection of remote digital loop.

4.6 Local Digital Loop.

AT command: **AT &T3**

Local digital loop makes it possible for the modem to return data received from the remote modem.

Some modems are unable to control remote digital loop after CCITT V.54 loop 2.

The command makes it possible for the remote modem to perform a test involving a remote digital loop and the telephone line even though it has not implemented CCITT V.54 remote loop 2.

Note:

In order to use the test an operator must be present at both modems.

A connection between the modem and the remote modem is established so that they are both in the data mode. As the remote modem requires test of the telephone line and its own receiver and transmitter the modem is placed in a digital loop. Then it is possible for the remote modem to perform a test.

Example 4.5:

Local digital loop with manual disconnection, the modem in the command mode.

Terminal: **+++**
Escape sequence.

Modem: **OK**
The modem is in the command mode.

Terminal: **AT &T3**
Terminate test.

When the operator of the remote modem informs the operator of the LASAT modem that the test is terminated (i.e. via a normal telephone connection) the local digital loop is disconnected as follows:

Terminal: **AT &T0**
Stop test.

Modem: **OK**
Test terminated.

5. Error Correction and Data Compression.

In this chapter the terms error correction and data compression are described. Proper configuration of the modem is described in chapter 2.

The modem can use error correction and data compression. The error correction is compatible with CCITT V.42 (incl. Annex A). The data compression is compatible with CCITT V.42bis and MNP5.

In case of error correction, data which have been destroyed during the transmission are re-transmitted, so that only correct data are passed to the terminal. This procedure ensures that data are transmitted 100% error free. If re-transmissions are unnecessary, there is a possibility to increase the character flow through the modem with up to 120% of the data rate. This is possible because data from the terminal to the modem are transferred asynchronously (10 bps) whereas data between the modems can be transferred synchronously (8 bps).

Data compression makes it possible to increase the efficient number of characters transmitted from the modem. The character flow can be increased from between 200% (MNP5) to 400% (V.42bis) dependent on the kind of data compression used. The modem either reduces the number of transferred bit (MNP5) or recognizes patterns in the data flow and send a code for the pattern instead (V.42bis).

Data compression should be used with caution. Data compression is best at big data quantities and at data which are not already compressed. If data are compressed already the use of data compression could lead to a reduced efficiency.

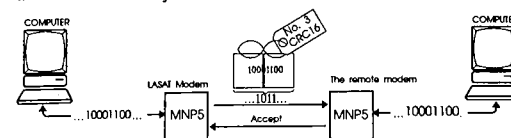


Fig. 5.1 Data transmitted with a MNP5 protocol. The data flow rate can be up to 200% of the data signalling rate and it ensures that data are transmitted error free.

An error correcting procedure makes sure that the origin modem packs data received from the terminal in blocks. Each block is given a number together with a value which determines if data are received error free. Then the block is sent to the answer modem which on receipt will inspect if the block is error free.

If the data are error free the answer modem transmits an acceptance, otherwise it will ask for a re-transmission. As the origin modem is able to transmit several blocks before receiving an acceptance from the answer modem the answer modem uses the block number to ensure that the blocks are delivered to the terminal in the right order. Fig. 6.1 shows the above with MNP2-5 as error correcting/data compressing procedure.

The origin modem can re-transmit the same block up to 12 times before giving up. If a block is not accepted by the answer modem after the retransmissions it can depending on the choice of the error correcting procedure disconnect the connection or try to establish the connection again with other parameters for the error correction procedure.

The block size varies according to the quantity of data available to the modem. This means that the modem constantly watches the data flow from the terminal. If a gap occurs in the data flow the modem will compress the existing data and transmit these. Consequently, the block size for interactive communication typically only consists of a few characters whereas it is of maximum size as regards the file transmission.

Before the connection is established the maximum block size must be determined (A) to between 64 and 256 bytes. On a good telephone line where no errors occur the maximum block size is selected. If, on the other hand the line is very noisy a smaller block size is selected. In this way the possibility of transmitting the block error free will increase and the current character throughput increases.

Please note that the data signalling rate on the telephone line is still the same but the character throughput will increase.

The selected block size should also be adapted to the connected equipment if it in one way or another receives data in blocks (f.ex.

during file transfer). If this is the case the block size of the modem must be less than that of the connected equipment.

If the equipment connection uses some kind of error correcting procedure the error correcting procedure of the modem should be disconnected.

If as regards data compression V.42bis is selected the data compression is automatically disconnected if the efficiency is falling. If on the other hand MNP5 is selected the user must disconnect the data compression himself.

Fig. 5.2 gives an example of what can be achieved with the data compression MNP5.

5.1 Rate Converting.

In order to maximize the effect of the data compression facility it is necessary to select a data rate on the terminal which exceeds the maximum data throughput

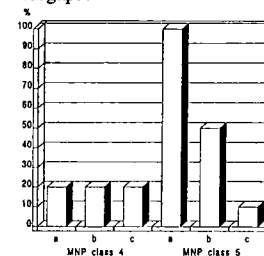


Fig. 5.2 Increase of the data rate for error correction (MNP4) and data compression (MNP5) at different types of files. A: ASCII file, B: Binary file, C: Compressed file.

If "Direct mode" (N1) is not selected the modem offers automatic rate converting between the terminal interface and the data signalling rate on the telephone line. This makes it possible to combine the rates 1200 -

14400 bps on the line side with the rates 1200 - 56800 bps on the terminal side according to demand.

A fixed rate is typically used on the terminal interface whereas the modems calling decide the rate on the line.

The rate converting ensures that the modem with data compression never lacks new data. As the modem must store the data which cannot be sent immediately buffers must be used. They are of a limited size. This means that it must be ensured that the modem does not receive more data than it is capable of transmitting.

5.2 Flow Control.

The modem offers two types of flow control. Software flow control with XON/XOFF characters and hardware flow control with the serial signals RTS/CTS.

In order to be able to use flow control it is necessary that the terminal is able to support one of the two methods. If this is not the case the data signalling rate on the terminal interface must be selected to correspond with the data signalling rate on the telephone line in order to avoid that data are lost.

Software flow control can be used between terminal and modem and/or between the two modems. If error correction is used the software flow control between the modems cannot be used, as the error correction forms the flow control.

When the modem cannot receive more characters from the terminal, it transmits the character XOFF (CTRL-S) to the terminal, which then must stop its transmission of data to the modem. When the modem is able to receive data from the terminal again it transmits a XON character (Ctrl- Q) to the terminal which can resume the transmission of data.

The flow control works both ways between modem and terminal. This means that if the terminal is unable to receive data it sends a XOFF character. The XON/XOFF characters will not be transmitted to the

remote modem.

As mentioned XON/XOFF flow control can also be used between the modems if error correction is not used. The modem which is unable to receive more data from the other modem inserts a XOFF character in the data flow. The other modem recognizes the XOFF character, removes it from the data flow and stops the transmission of data until a XON character is received.

The XON/XOFF characters make demands on the data to be sent. It will result in transmission problems if the data contain these two characters. The method is best suited for transmission of ASCII files without control characters, terminal sessions and the like. Files which are unsuitable for transmission under software control are binary data files and executable programmes, as these may contain XON/XOFF characters. Software flow control between modems can only be used in "Normal" and "Direct" mode (N0, N1).

The hardware flow control (&K3) has the advantage that it does not involve the data which are transmitted. The modem indicates to the terminal that it cannot receive data by setting the serial signal CTS OFF. When the modem can receive data again CTS is set ON as an indication that the terminal can resume the transmission. If necessary the terminal can indicate to the modem to stop receiving data by setting the serial signal RTS OFF, when the terminal is able to receive data.

5.3 Test and Error Correction.

Normally the error correcting procedure will correct all errors which might occur during the data transmission.

However, errors might occur which makes it necessary to examine the telephone line, the local modem or the remote modem. The errors will typically appear as an increased error rate with many re-transmissions.

To perform a test the modem must be in an asynchronous operation in non-error-correction mode ("Normal" or "Direct" mode)

For further information please see chapter 4, "Test of modem and telephone line".

5.4 MNP10.

This chapter has described the terms error correction and data compression. To make the most out of the modem and the telephone line the LASAT modem offers Microcom's MNP10.

MNP 10 is the newest class of the Microcom Networking Protocol and can be viewed as an "enabling technology". Figure 5.3 depicts the MNP 10 architecture.

MNP 10 sits on top of CCITT modulation standards such as V.22bis and V.32bis, as well as the specifications for data compression and error control, to maximize modem performance while assuring compatibility with all recognized international standards.

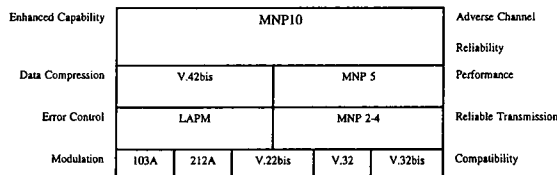


Fig 5.3 MNP 10 Architecture.

The Adverse Channel Enhancement component is key to MNP 10 and provides two distinct benefits:

- Improved chances of achieving connections in particularly difficult transmission environments;
- Overall performance is enhanced considerably with the optimization of modem transmission speed and MNP 10 packet size.

These Adverse Channel Enhancements fall into five categories:

Negotiated Speed Upshift begins the modem handshake at the lowest possible modulation speed to establish a robust connection (other modems are limited to the speeds dictated by the modulation standards they support and thus may initiate the connection at a speed at which it is impossible to achieve any connection at all due to line noise.). Once the connection is made and if line conditions permit, MNP

modems immediately upshift to the highest possible speed.

Robust Auto-Reliable mode enables MNP10 modems to establish a reliable link during noisy call set-ups. Because the call set-up is the most vulnerable portion of the MNP session, this feature makes multiple attempts to overcome channel interference (currently other MNP levels make only one attempt). In addition, Robust Auto-Reliable is fully compatible with existing MNP and non-MNP modems, virtually ensuring link establishment where non-MNP 10 modems fail to achieve connections.

Dynamic Speed Shift continuously adjusts speeds throughout the connection in response to prevailing line conditions. This downshifting and upshifting across modulation schemes provides the highest possible speeds the line can reliably support. For example, a modem may downshift to 1200 bps during conditions of high noise to maximize "line survivability" while minimizing the number of packets that need to be retransmitted. When conditions permit, the modem will once again upshift speeds. During idle time this feature monitors line conditions to ascertain the most optimal speed.

Aggressive Adaptive Packet Assembly improves link and transmission performance under adverse conditions. Packet sizes vary from 8 to 256 bytes. Traditional MNP modems use large packets of data at the beginning of a transmission session and reduce packet size if too many errors occur. For example, MNP4 allows for fixed packet sizes of 32, 64, 128, 192 and 256 bytes. An MNP 10 modem relies on the reverse technique by establishing a link with small data packets and aggressively increasing size as conditions permit. Aggressive Adaptive Assembly performs packet calculations during idle time to determine the optimum packet size.

Dynamic Transmit Level Adjustment (DTLA) is designed specifically to maximize performance on cellular connections. Starting at 1200 bps, DTLA determines a modem's ideal transmit level for the prevailing line conditions. Once the cellular connection is established, DTLA continually samples transmit level statistics using link management packets and adjust transmit levels as required.

6. Synchronous Data Signalling.

This chapter only complies to external modems except chapter 6.4 which also complies to internal modems.

In addition to asynchronous data signalling the modem may also be used for synchronous data signalling. In order to obtain a synchronous data mode the modem must be configured to synchronous data signalling from an asynchronous terminal.

When operating synchronously the data transmitted are synchronized by means of a clock signal where start and stop bit used in asynchronous data signalling are unnecessary. This means that it is possible to transmit up to 30% more data when signalling synchronously than when signalling asynchronously.

6.1 Synchronous Clock Signal.

Data which are to be transmitted can be synchronized by a clock generated by the modem (standard configuration) by the received carrier (&X2) or by a clock received from the serial interface (&X1).

The clock selected is available on the serial port pin 15 which "transmit signal element timing - DCE source" (CCITT V.24, 114). If the clock is received from the serial interface this takes place on pin 24 as "transmit signal element timing - DTE source" (CCITT V.24, 113).

The synchronizing clock of the received data is derived from the receiving carrier. It is available on the modem's serial port pin 17 as "receive signal element timing - DCE source" (CCITT V.24, 114).

6.2 Establishing a Synchronous Connection.

Establishing a synchronous connection can be accomplished in two ways.

1. From asynchronous mode where answer to a call is made.

2. It can be controlled by the serial port by means of the DTR signal (108/1).

6.2.1 Asynchronous Command Mode.

The modem works with the command interpreter as in the asynchronous mode. When a connection is established it is done in synchronous mode. This means that the connection can be established by an ATD command. This synchronous mode is obtained by the command AT &Q1 <CR>.

If the command interpreter is used it is a necessity that it is possible to change the serial port of the terminal from an asynchronous to a synchronous data signalling with the terminal as soon as the synchronous connection has been established. This can be done by a terminal at which it is possible to change from the asynchronous to synchronous operation on the same serial port or by relocating the cable from an asynchronous to a synchronous terminal. The modem allows this by ignoring the status on the DTR signal for a certain period after the connection has been established. This period is stated in register S25 in seconds (standard 0.05 seconds). It is also possible to ignore the DTR signal completely.

The modem is capable of working as an answer modem like in the asynchronous mode but with the exception that it cannot be brought from data mode to command mode by using the escape characters (+++).

The data signalling connection is disconnected when the remote modem disconnects the connection or when DTR is set off by the terminal.

6.2.2 DTR controlled Synchronous Connection.

This function makes it possible to control the modem by means of the serial signal DTR. It comprises the function "Connect data set to line", or establish modem connection CCITT V.24, 108/1). The connection can be established after a manual call to the remote modem (the &Q3 command) or by dialling number stored in the memory (the &Q2

command).

When DTR goes from OFF to ON the modem attempts to establish the required synchronous data connection. If the auto dial function is used, DTR is set ON when the connection is to be established. The modem makes the call automatically to the stored number and the connection is established. If manual dialling is made the call is made on a parallel telephone. When the remote modem answers DTR is set ON.

When using an emulation programme (f.ex. 3270, 5250) to a computer, DTR is usually set ON when the programme is initiated. It is important that DTR is set OFF when the programme is left.

The modem can function as an answer modem if it is configured to auto answer (register S0 different from 0). When the modem receives a call this is signalled on the serial RI signal pin 22 (CCITT V.24, 125). The computer/terminal can request the modem to answer the call by setting DTR ON. Then the modem answers the call when the number of rings is equal to S0. The computer can reject the call by keeping DTR OFF. From the time that a call has been completed and until the modem sets S1 (number of rings) to 0 the modem establishes connection as an answer modem if DTR goes on. This period is 10 seconds. Then the modem will again establish a connection as A-modem.

When a DTR controlled mode has been selected the modem will attempt to establish a connection when a terminal is connected. This can be avoided by switching off the modem while the terminal is being connected.

6.3 V.24 Signalling during Synchronous Establishment.

During the establishment of a synchronous connection the modem complies with the chosen recommendation (V.32bis/V.32/V.22bis/V.22/V.21/V.23) for signalling via a serial V.24 port. When the modem has detected an answer tone from the remote modem the data set ready (DSR) is set ON (107). When a carrier has been detected data carrier detect (DCD) is set ON (109). The terminal/computer may now begin to transmit data. The transmission can be controlled by RTS (105) and CTS (106). The function of these signals are controlled by the &R command.

If DTR goes OFF during the data signalling the modem switches off the connection to the telephone line and returns to the command mode.

6.4 Autosync.

This chapter also complies to internal modems.

AutoSync is a Hayes Microcomputer Products defacto standard. AutoSync provides your LASAT modem with the capability to communicate synchronously from an asynchronous IBM PC-port without a synchronous interface adaptor card. AutoSync is a firmware feature of the modem which when enabled by synchronous communication software containing the Hayes Synchronous Driver (HSD), allows the modem to establish a call asynchronously, then automatically switch to synchronous operation. All programming necessary to support AutoSync is contained with HSD.

AutoSync is a user-selected feature. AT-commands are used to select the AutoSync mode and the DTR read option. The data terminal must apply an "ON" condition to DTR before on-line data transfer can begin. In AutoSync mode, the modem first places a call from the asynchronous command state by issuing a dial command. Once the connection is established, HSD is activated and the modem can communicate synchronously. HSD functions only during the on-line active period of a communication session. It provides no support for call establishment, auto-answer, or other call-related tasks.

AutoSync transfers synchronous data between HSD and the modem's microprocessor. The computer's asynchronous port is simply used as a communication channel. HSD queries the modem to ensure that it supports AutoSync, then communicates with the modem's microprocessor, instructing it to convert the data between the asynchronous and synchronous formats before transmitting or receiving the data across the communication link.

The modem exits the synchronous on-line state and returns to the asynchronous command state when a loss of carrier or an on-to-off transition of DTR is detected.

If AutoSync is used the communication software will take care of the

above mentioned communication. The only action necessary to use AutoSync by the user is to start the communication software.

A.1 S-Registers.

The S registers are summarized in Table A-1 along with their default values. Registers denoted with an '*' in Table A-1 may be stored in one of the two user profiles by entering the &Wn command. One of these profiles may be loaded at any time by using the Zn command. Registers or register fields quoted as "reserved" are reserved for current or future use by the firmware, or are permanently overridden by PTT limitations.

All bit-mapped registers are read-only.

The appropriate AT command which controls the relevant bits in the S-register should be used to change the value.

A.1.1 Factory Defaults.

The factory default values are stored in ROM and are loaded into the active configuration at power up or by the ATZn command. In addition, the designated default profile is subsequently loaded, and may change some of the factory default values. The designated default profile can be changed by entering the &Yn command where n is one of the two possible user profiles.

The defaults shown are those used by LASAT in factory profiles zero and one. Factory profiles are firmware revision dependent and may be changed without further notice.

All of the factory default values may be loaded at any time by entering the &F command.

Table A-1. S Register Summary

Register	Function	Range	Units	Save	Default
S0	Rings to Auto-Answer	0-255	rings	*	2
S1	Ring Counter	0-255	rings		0
S2	Escape Character	0-255	ASCII	*	43
S3	Carriage Return Character	0-127	ASCII		13
S4	Line Feed Character	0-127	ASCII		10
S5	Backspace Character	0-255	ASCII		8
S6	Wait Time for Dial Tone	2-255	s	*	4
S7	Wait Time for Carrier	1-255	s	*	50
S8	Pause Time for Dial Delay Modifier	0-255	s	*	2
S9	Carrier Detect Response Time	1-255	0.1 s	*	6
S10	Carrier Loss Disconnect Time	1-255	0.1 s	*	14
S11	DTMF Tone Duration	50-255	0.001s	*	95
S12	Escape Code Guard Time	0-255	0.02s	*	50
S13	Reserved	-	-		-
S14	General Bit Mapped Options	-	-	*	138/8Ah
S15	Reserved	-	-		-
S16	Test Mode Bit Mapped Options(&T)	-	-		0
S17	Reserved	-	-		-
S18	Test Timer	0-255	s	*	0
S19-20	Reserved	-	-		-
S21	V.24/General Bit Mapped Options	-	-	*	4/04h
S22	Speaker/Results Bit Mapped Options	-	-	*	117/75h
S23	General Bit Mapped Options	-	-	*	183/87h
S24	Sleep Inactivity Timer	0-255	s		0
S25	Delay to DTR Off	0-255	s/0.01s		5
S26	RTS-to-CTS Delay	0-255	0.01 s		1
S27	General Bit Mapped Options	-	-	*	9/09h
S28	General Bit Mapped Options	-	-	*	0

Table A-1. S Register Summary (cont'd)

Register	Function	Range	Units	Save	Default
S29	Flash Dial Modifier Time	0-255	10 ms		0
S30	Disconnect Inactivity Timer	0-255	10 s		0
S31	General Bit Mapped Options	-	-	*	2
S32	XON Character	0-255	ASCII		17/11h
S33	XOFF Character	0-255	ASCII		19/13h
S34-S35	Reserved	-	-		-
S36	LAPM Failure Control	-	-	*	7
S37	Line Connection Speed	-	-	*	0
S38	Delay Before Forced Hangup	0-255	s		20
S39	Flow Control	-	-	*	3
S40	General Bit Mapped Options	-	-	*	107/6Bh
S41	General Bit Mapped Options	-	-	*	3
S42-S45	Reserved	-	-		-
S46	Data Compression Control	-	-	*	138/8Ah
S48	V.42 Negotiation Control	-	-		7
S80	Soft-Switch Functions	-	-		0
S82	LAPM Break Control	-	-		128/40h
S86	Call Failure Reason Code	0-255	-		-
S91	PSTN Transmit Attenuation Level	0-15	dBm		10
S92	Fax Transmit Attenuation Level	0-15	dBm		10
S95	Result Code Messages Control	-	-	*	0
S99	Leased Line Transmit Level	0-15	-dBm		10
S202	Remote Access Escape Character	0-255	ASCII		170

A.1.2 S-Register Definitions.

S0 - Number of Rings to Auto-Answer

Sets the number of the rings required before the modem automatically answers a call. Setting this register to zero disables auto-answer mode.

Range: 0-255 rings

Default: 0

S1 - Ring Counter

Sets the number of the rings required before the modem answers a call. If no rings occur over an eight second interval, this register is cleared.

Range: 0-255 rings

Default: 0

S2 - Escape Character

S2 holds the decimal value of the ASCII character used as the escape character. The default value corresponds to an ASCII '+'. A value over 127 disables the escape process, i.e., no escape character will be recognized.

Range: 0-255, ASCII decimal

Default: 43 (+)

S3 - Carriage Return Character

Sets the command line and result code terminator character. Pertains to asynchronous operation only.

Range: 0-127, ASCII decimal

Default: 13 (Carriage Return)

S4 - Line Feed Character

Sets the character recognized as a line feed. Pertains to asynchronous operation only. The Line Feed control character is output after the Carriage Return control character if verbose result codes are used

Range: 0-127, ASCII decimal

Default: 10 (Line Feed)

S5 - Backspace Character

Sets the character recognized as a backspace. Pertains to asynchronous operation only. The modem will not recognize the Backspace character if it is set to a value that is greater than 32 ASCII. This character can be used to edit a command line. When the echo command is enabled, the modem echoes back to the local DTE the Backspace character, an ASCII space character and a second Backspace character; this means a total of three characters are transmitted each time the modem processes the Backspace character.

Range: 0-32, ASCII decimal

Default: 8 (Backspace)

S6 - Wait Time for Dial Tone or Before Blind Dialling.

Sets the length of time, in seconds, that the modem will wait for dial tone. Alternatively when blind dialling it sets the length of time, in seconds, that the modem will wait before starting to dial after going off-hook. This operation, however, may be affected by some ATX options according to country restrictions. The "Wait for Dial Tone" call progress feature (W dial modifier in the dial string) will override the value in register S6.

The modem always pauses for a minimum of 2 seconds, even if the value of S6 is less than 2 seconds.

Range: 2-255 seconds

Default: 4

S7 - Wait Time For Carrier After Dial, For Silence.

1. Sets the length of time, in seconds, that the modem will wait for carrier before hanging up. The timer is started when the modem finishes dialling (originate), or 2 seconds after going off-hook (answer). In originate mode, the timer is reset upon detection of answer tone if allowed by country restrictions.

2. Sets the length of time, in seconds, that modem will wait for silence when encountering the @ dial modifier before continuing with the next dial string parameter.

Range: 1-255 seconds

Default: 50

S8 - Pause Time For Dial Delay

Sets the time, in seconds, that the modem must pause when the ", " dial modifier is encountered in the dial string.¹

Range: 0-255 seconds

Default: 2

S9 - Carrier Detect Response Time

Sets the time, in tenths of a second, that the carrier must be present before the modem considers it valid and turns on RLSD. As this time is increased, there is less chance to detect a false carrier due to noise from the telephone line.

Range: 1-255 tenths of a second

Default: 6 (0.6 second)

S10 - Lost Carrier To Hang Up Delay

Sets the length of time, in tenths of a second, that the modem waits before hanging up after a loss of carrier. This allows for a temporary carrier loss without causing the local modem to disconnect. When register S10 is set to 255, the modem functions as if a carrier is always present.

The actual interval the modem waits before disconnecting is the value in register S10 minus the value in register S9. Therefore, the S10 value must be greater than the S9 value or else the modem disconnects before it recognizes the carrier.

Range: 1-255 tenths of a second

Default: 14 (1.4 seconds)

S11 - Reserved**S12 - Escape Code Guard Time**

Defines the maximum period, in fiftieths of a second, allowed between consecutive asynchronous escape characters (+) for the escape sequence to be considered valid.

Range: 0-255 1/50 of a second

Default: 50 (1 second)

S13 - Reserved**S14 - General Bit Mapped Options**

Indicates the status of command options.

Default: 138 (8Ah) (10001010b)

Bit 0 -- This bit is ignored.

Bit 1 -- Command echo (En)

0 = Disabled (E0)

1 = Enabled (E1) (Default.)

Bit 2 -- Quiet mode (Qn)

0 = Send result codes (Q0) (Default.)

1 = Do not send result codes (Q1)

Bit 3 -- Result codes (Vn)

0 = Numeric (V0)

1 = Verbose (V1) (Default.)

Bit 4 -- Reserved

Bit 5 -- Tone (T)/Pulse (P)

0 = Tone (T) (Default.)

1 = Pulse (P)

Bit 6 -- Reserved

Bit 7 -- Originate/Answer

0 = Answer

1 = Originate (Default.)

S15 - Reserved

S16 - General Bit Mapped Test Options

Indicates the test in progress status.

Default: 0

- Bit 0 -- Local analog loopback
0 = Disabled (Default.)
1 = Enabled (&T1)
- Bit 1 -- Not used
- Bit 2 -- Local digital loopback
0 = Disabled (Default.)
1 = Enabled (&T3)
- Bit 3 -- Remote digital loopback (RDL) status
0 = Modem not in RDL
1 = RDL in progress
- Bit 4 -- RDL requested (AT&T6)
0 = RDL not requested (Default.)
1 = RDL requested (&T6)
- Bit 5 -- RDL with self test
0 = Disabled (Default.)
1 = Enabled (&T7)
- Bit 6 -- Local analog loopback (LAL) with self test
0 = Disabled (Default.)
1 = Enabled (&T8)
- Bit 7 -- Not used

S17 - Reserved**S18 - Test Timer**

Sets the length of time, in seconds, that the modem conducts a test (commanded by &Tn) before returning to the command mode. If this register value is zero, the test will not automatically terminate; the test must be terminated from the command mode by issuing an &T0 or H command. When S18 is non-zero, the modem returns the OK message upon test termination.

Range: 0-255 seconds

Default: 0

S19 - S20 - Reserved**S21 - V.21/General Bit Mapped Options**

Indicates the status of command options.

Default: 116 (74h) (01110100b)

- Bit 0 -- Set by &Jn command but ignored otherwise.
0 = &J0 (Default.)
1 = &J1
- Bit 1 -- Reserved
- Bit 2 -- CTS behaviour (&Rn)
0 = CTS always on (&R0)
1 = CTS tracks RTS (&R1) (Default.)
- Bit 3,4 -- DTR behaviour (&Dn)
0 = &D0 selected
1 = &D1 selected
2 = &D2 selected (Default)
3 = &D3 selected
- Bit 5 -- RLSD (DCD) behaviour (&Cn)
0 = &C0 selected
1 = &C1 selected (Default)
- Bit 6 -- DSR behaviour (&Sn)
0 = &S0 selected
1 = &S1 selected (Default)
- Bit 7 -- Long space disconnect (Yn)
0 = Y0 (Default)
1 = Y1

S22 - Speaker/Results Bit Mapped Options

Indicates the status of command options.

Default: 117 (75h) (01110101b)

- Bit 0,1 -- Speaker volume (Ln)
 0 = Off (L0)
 1 = Low (L1) (Default.)
 2 = Medium (L2)
 3 = High (L3)
- Bit 2,3 -- Speaker control (Mn)
 0 = Disabled (M0)
 1 = Off on carrier (M1) (Default.)
 2 = Always on (M2)
 3 = On during handshake (M3)
- Bit 4,5,6 -- Limit result codes (Xn)
 0 = X0
 4 = X1
 5 = X2
 6 = X3
 7 = X4 (Default.)
- Bit 7-- Reserved

S23 - General Bit Mapped Options

Indicates the status of command options.

Default: 183 (B7h) (10110111b)

- Bit 0-- Grant RDL
 0 = RDL not allowed (&T5)
 1 = RDL allowed (&T4) (Default.)
- Bit 1,2,3 -- Assumed DTE Rate
 0 = 0 - 300 bps
 1 = 600 bps
 2 = 1200 bps
 3 = 2400 bps (Default.)
 4 = 4800 bps
 5 = 9600 bps
 6 = 19200 bps
- Bit 4,5 -- Assumed DTE parity
 0 = even
 1 = not used
 2 = odd
 3 = none (Default.)
- Bit 6,7 -- Guard tone (&Gn)
 0 = None (&G0)
 1 = None (&G1)
 2 = 1800 Hz (&G2) (Default)

S24 - Sleep Inactivity Timer

Sets the length of time, in seconds, that the modem will operate in normal mode with no detected telephone line or DTE line activity before entering low-power sleep mode. The timer is reset upon any DTE line or telephone line activity. If the S24 value is zero, neither DTE line nor telephone inactivity will cause the modem to enter the sleep mode.

Range: 0-255 seconds

Default: 0

S25 - Delay To DTR

Sets the length of time that the modem will ignore DTR for before hanging up. Its units are seconds for synchronous mode 1 and one hundredths of a second for other modes.

Range: 0-255 (1 sec. for synchronous mode 1; 0.01 sec. otherwise)

Default: 5

S26 - RTS to CTS Delay

Sets the time delay, in hundredths of a second, before the modem turns CTS ON after detecting an OFF-to-ON transition on RTS when &R0 is commanded. Pertains to synchronous operation only.

Range: 0-255 hundredths of a second

Default: 1

S27 - Bit Mapped Option

Indicates the status of command options.

Default: 9 (09h) (00001001b)

Bit 0,1,3 -- Synchronous/asynchronous selection (&Mn/&Qn)

3 1 0

0 0 0 = &M0 or &Q0

0 0 1 = &M1 or &Q1

0 1 0 = &M2 or &Q2

0 1 1 = &M3 or &Q3

1 0 0 = &Q4

1 0 1 = &Q5

1 1 0 = &Q6

Bit 2 -- Leased line control (&Ln)

0 = Dial up line (&L0) (Default.)

1 = Leased line (&L1)

Bit 4,5 -- Internal clock select (&Xn)

0 = Internal clock (&X0) (Default.)

1 = External clock (&X1)

2 = Slave clock (&X2)

Bit 6 -- CCITT/Bell mode select (Bn)

0 = CCITT mode (B0) (Default.)

1 = Bell mode (B1)

Bit 7 -- Reserved

S28 - Bit Mapped Options

Default: 0

Bit 0 -- V.23 split screen (&Wn)

0 = Disabled (&W0) (Default.)

1 = Enabled (&W1)

Bit 1 -- V.23 split screen direction

0 = 75 Tx /1200 Rx (%F1) (Default.)

1 = 1200 Tx /75 Rx (%F2)

Bit 2 -- Reserved (always 0).

Bit 3,4 -- Pulse dialling (&Pn)

0 = 39%-61% make/break ratio at 10 pulses per second (&P0) (Default.)

1 = 33%-67% make/break ratio at 10 pulses per second (&P1)

2 = 39%-61% make/break ratio at 20 pulses per second (&P2)

3 = 33%-67% make/break ratio at 20 pulses per second (&P3)

Bit 5 -- Reserved

Bit 6-7 -- MNP Link Negotiation Speed (*Hn)

0 = Link negotiation at highest speed (*H0) (Default.)

1 = Link negotiation at 1200 bps (*H1)

2 = Link negotiation at 4800 bps (*H2)

S29 - Flash Dial Modifier Time

Sets the length of time, in units of 10 ms, that the modem will go on-hook when it encounters the flash (!) dial modifier in the dial string.

Note:

The time can be limited as it is a country dependent parameter.

Range: 0-255 10 ms intervals

Default: 0 (disabled)

S30 - Disconnect Inactivity Timer

Sets the length of time, in tens of seconds, that the modem will stay online before disconnecting when no data is sent or received. In error-correction mode, any data transmitted or received will reset the timer. In other modes, any data transmitted will reset the timer. The timer is inoperative in synchronous mode.

Range: 0-255 tens of seconds (0-2550 seconds)

Default: 0 (disabled)

S31 - Bit Mapped Options

Default: 2 (00000010b)

Bit 0 -- Reserved

Bit 1 -- Controls auto line speed detection (Nn)

0 = Disabled (N0)

1 = Enabled (N1) (Default.)

Bit 2,3 -- Controls error correction progress messages (Wn)

0 = DTE speed only (W0) (Default.)

1 = Full reporting (W1)

2 = DCE speed only (W2)

Bit 3 -- Reserved

Bit 4-7 -- Reserved

S32 - XON Character

Sets the value of the XON character.

Range: 0-255, ASCII decimal

Default: 17 (11h)

S33 - XOFF Character

Sets the value of the XOFF character.

Range: 0-255, ASCII decimal

Default: 19 (13h)

S34-S35**S36 - LAPM Failure Control**

Default: 7 (00000111b)

Bit 0-2 -- This value indicates what should happen upon a LAPM failure.

These fallback options are initiated immediately upon connection if S48=128. If an invalid number is entered, the number is accepted into the register, but S36 will act as if the default value has been entered.

0 = Modem disconnects.

1 = Modem stays on-line and a Direct mode connection is established.

2 = Reserved.

3 = Modem stays on-line and a Normal mode connection is established.

4 = An MNP connection is attempted and if it fails, the modem disconnects.

5 = An MNP connection is attempted and if it fails, a Direct mode connection is established.

6 = Reserved.

7 = An MNP connection is attempted and if it fails, a Normal mode connection is established. (Default)

Bit 3-7 -- Reserved

S37 - Desired Line Connection Speed

- Default: 0
- Bit 0-3 -- Desired line connection speed. This is interlinked with the Fn command. If an invalid number is entered, the number is accepted into the register, but S37 will act as if the default value has been entered.
- 0 = Attempt auto mode connection (F0). (Default)
 - 1-3 = Attempt to connect at 300 bps (F1).
 - 4 = Reserved.
 - 5 = Attempt to connect at 1200 bps (F4).
 - 6 = Attempt to connect at 2400 bps (F5).
 - 7 = Attempt to connect at V.23 (F3).
 - 8 = Attempt to connect at 4800 bps (F6).
 - 9 = Attempt to connect at 9600 bps (F8).
 - 10 = Attempt to connect at 12000 bps (F9).
 - 11 = Attempt to connect at 14400 bps (F10).
 - 12 = Attempt to connect at 7200 bps (F7).
- Bit 4-7 -- Reserved

S38 - Delay Before Forced Hang Up

This register specifies the delay between the modem's receipt of the H command to disconnect (or ON-to-OFF transition of DTR if the modem is programmed to follow the signal), and the disconnect operation. Applicable to error-correction connection only. This register can be used to ensure that data in the modem buffer is sent before the modem disconnects.

1. If S38 is set to a value between 0 and 254, the modem will wait that number of seconds for the remote modem to acknowledge all data in the modem buffer before disconnecting. If time expires before all data is sent, the NO CARRIER result code will be issued to indicate that data has been lost. If all data is transmitted prior to time-out, the response to the H0 command will be OK.
2. If S38 is set to 255, the modem does not time-out and continues to attempt to deliver data in the buffer until the connection is lost or the data is delivered.

Range: 0-255 seconds

Default: 20

S39 - Flow Control

- Default: 3 (00000011b)
- Bits 0-2 -- Status of command options
- 0 = No flow control
 - 3 = RTS/CTS (&K3) (Default.)
 - 4 = XON/XOFF (&K4)
 - 5 = Transparent XON (&K5)
 - 6 = Both methods (&K6)
- Bits 3-7 -- Reserved

S40 - General Bit Mapped Options

Indicates the status of command options.

- Default: 107 (6Bh) (01101011b)
- Bit 0 -- MNP Extended Services (-Kn)
- 0 = Disable extended services (-K0)
 - 1 = Enable extended services (-K1) (Default)
- Bit 1-- Enable fallback to V.22bis/V.22 (-Qn)
- 0 = Disabled (-Q0)
 - 1 = Enabled (-Q1) (Default.)
- Bit 2-- Power Level Adjustment for Cellular Use (JMn)
- 0 = Auto-adjustment (JM0) (Default.)
 - 1 = Force adjustment (JM1)
- Bits 3-5 -- Break Handling (\Kn)
- 0 = \K0
 - 1 = \K1
 - 2 = \K2
 - 3 = \K3
 - 4 = \K4
 - 5 = \K5 (Default.)
- Bits 6-7 -- MNP block size (\An)
- 0 = 64 chars (\A0)
 - 1 = 128 chars (\A1) (Default.)
 - 2 = 192 chars (\A2)
 - 3 = 256 chars (\A3)

S41 - General Bit Mapped Options

Indicates the status of command options.

Default: 3 (00000011b)

Bits 0 -1 -- Compression selection (%Cn)

0 = Disabled (%C0)

1 = MNP 5 (%C1)

2 = V.42 bis (%C2)

3 = MNP 5 and V.42 bis (%C3) (Default.)

Bit 2, 6-- Auto retrain and fallback/fall forward (%En)

Bit 6 Bit 2

0 0 = Retrain and fallback/fall forward disabled (%E0) (Default)

0 1 = Retrain enabled (%E1)

1 0 = Fallback/fall forward enabled (%E2)

Bit 3 -- Modem-to-modem flow control

0 = Disabled (\G0) (Default.)

1 = Enabled (\G1)

Bit 4 -- Block mode control (\Ln)

0 = Stream mode (\L0) (Default.)

1 = Block mode (\L1)

Bit 5 -- Reserved

Bit 7 -- Reserved

S46 - Data Compression Control

Controls selection of compression. The following actions are executed for the given values:

Range: 136 or 138

Default: 138

S46=136 Execute error correction protocol with no compression.

S46=138 Execute error correction protocol with compression. (Default.)

S48 - V.42 Negotiation Action

The V.42 negotiation process determines the capabilities of the remote modem. However, when the capabilities of the remote modem are known and negotiation is unnecessary, this process can be bypassed if so desired.

Range: 0, 7, or 128 If an invalid number is entered, it is accepted into the S register, but S48 will act as if 128 has been entered.

Default: 7

S48=0 Disable negotiation; bypass the detection and negotiation phases; and proceed with LAPM.

S48=7 Enable negotiation. (Default.)

S48=128 Disable negotiation; bypass the detection and negotiation phases; and proceed at once with the fallback action specified in S36. Can be used to force MNP.

S80 - Soft-Switch Functions

Default: 1

Bits 0-4 -- Reserved

Bit 5 -- V.25 bis/AT command mode select (AT/V25B signal)

0 = AT selected

1 = V.25 bis selected

Bit 6 -- Remote configuration permitted (REMCONF signal)

0 = Remote configuration not permitted

1 = Remote configuration permitted

Bit 7 -- Call back security enforcement (SECACC signal)

0 = Call back security disabled

1 = Call back security enabled

S82 - Break Handling Options

Break signals provide a way for the user to get the attention of the remote modem. The break type depends on the specific application. LAPM specifies three methods of break signal handling: in sequence, expedited, and destructive. If an invalid number is entered, it is accepted into the S register, but S82 will act as if the default value has been entered.

Range: 3, 7, or 128

Default: 128

S82=3 Expedited: Modem sends a break immediately; data integrity is maintained both ahead of and after the break.

S82=7 Destructive: Modem sends a break immediately; data being processed by each modem at the time of the break is destroyed.

S82=128 In sequence: Modem sends a break in sequence with any transmitted data; data integrity is maintained both ahead of and after the break. (Default)

S86 - Call Failure Reason Code

When the modem issues a NO CARRIER result code, a value is written to this S register to help determine the reason for the failed connection. S86 records the first event that contributes to a NO CARRIER message.

The cause codes are:

Range: 0, 4, 5, 9, 12, 13, or 14

Default: -

S86=0 Normal disconnect, no error occurred.

S86=4 Loss of carrier.

S86=5 V.42 negotiation failed to detect an error-correction modem at the other end.

S86=6 No response to feature negotiation.

S86=7 This modem is asynchronous only; the other modem is synchronous only.

S86=8 No framing technique in common.

S86=9 The modems could not find a common protocol.

S86=10 Bad response to feature negotiation.

S86=11 No sync information from remote modem.

S86=12 Normal disconnect initiated by the remote modem.

S86=13 Remote modem does not respond after 10 re-transmissions of the same message.

S86=14 Protocol violation.

S91 - PSTN Transmit Attenuation Level

Sets the transmit attenuation level from 0 to 15 dBm for the PSTN mode, resulting in a transmit level from 0 to -15 dBm,

Note:

In some countries, the transmit level may not be changed.

Range: 0 to 15 dBm (Corresponding to 0 to -15 dBm transmit level.)

Default: 10 (-10 dBm transmit level.)

S92 - Fax Transmit Attenuation Level

Sets the transmit attenuation level from 0 to 15 dBm for the fax mode, resulting in a transmit level from 0 to -15 dBm.

Note:

In some countries, the transmit level may not be changed.

Range: 0 to 15 dBm (Corresponding to 0 to -15 dBm transmit level.)

Default: 10 (-10 dBm transmit level.)

S95 - Extended Result Codes

The bits in this register can be set to override some of the Wn command options. A bit set to a 1 in this register will enable the corresponding result code regardless of the Wn setting. Also, refer to Table 3-1.

Default: 0

Bit 0 = CONNECT result code indicates DCE speed instead of DTE speed.

Bit 1 = Append/ARQ to CONNECT XXXX result code in error correction mode (XXXX = rate; see Table 3-1).

Bit 2 = Enable CARRIER XXXX result code (XXXX = rate; see Table 3-1).

Bit 3 = Enable PROTOCOL XXXX result code (XXXX = protocol identifier; see Table 3-1).

Bit 4 = Reserved.

Bit 5 = Enable COMPRESSION result code (XXXX = compression type; see Table 3-1).

Bit 6 = Reserved.

Bit 7 = Reserved.

S99 - Leased Line Transmit Level

Sets the transmit level, in dBm, for the leased line mode.

Note:

In some countries this cannot be changed.

Range: 0 to -15 dBm

Default: 10

S202 - Remote Access Escape Character

S202 holds the decimal value of the ASCII character used as the escape character in the escape sequence from on-line to Remote Access. S202 works similar to S2 except that the S2 escape character is used in the escape sequence from on-line to the command mode.

Range: 0-255, ASCII decimal

Default: 170 (Escape disabled)

A value over 127 disables the escape process, i.e., no escape character will be recognized. The default S202 value of 170 disables the escape process to Remote Access (whereas the default S2 value enables escape to command mode). If 128 is subtracted from 170 (i.e., bit 7 is reset), the resulting 42 is the ASCII code for the '*' character. The '*' character is commonly used for the Remote Access escape character.

The Remote Access escape sequence consists of four characters with a fixed escape guard time of 1 second. Only the character selected by S202 is valid. When '*' is used for the escape character, the escape sequence is '****'.

The Remote Access escape sequence works when the modems are connected in any mode (normal, LAPM or MNP) except direct mode. The modem on which the remote commands are typed (the "local modem") does not need any special code associated with the remote configuration. The "remote modem" (whose configuration will be modified remotely) must have Remote Configuration Mode (RCM) enabled (bit 6 of S80).

The escape sequence entered by the user on the local modem is recognized by the remote modem, which then sends a message to the local mode prompting for entry of the "remote password". From then on, operation is similar to RCM except for slight differences of presentation. The remote modem will send a ">" prompt before each AT command. The user must type the AT prefix before the command(s), which is not required by RCM. Several commands on the same line can be accepted.

Some potentially hazardous AT commands are barred in Remote Access: ATO, ATZ, AT&T, ATB, AT+C, AT*L, AT*P, and ATZ.

Note:

that ATA and ATD are automatically barred because the modem is already connected.

To exit Remote Access, enter command AT*X. Upon exiting Remote Access, the normal data link is re-established and the "CONNECT" message is issued to the DTE.

Note:

that in RCM, exit is to the command mode, but actually, in both cases, return is to the previous state before entering Remote Access/RCM

AT*R and AT*E commands also operate the same as in RCM.

Remote Access can be exited by typing a remote ATH command. The connection will be terminated and a "NO CARRIER" response will be issued from the local modem to the DTE since the hangup was actually performed by the remote modem.

A.2 Cables.**A.2.1 RS232C Asynchronous/Synchronous cable connections.**

CCITT V.24/V.28 Equivalent	Type	Direction	Modem Male	Computer 25 D-Sub Female
101	FG	—	1	1
103	TXD	←	2	2
104	RXD	→	3	3
105	RTS	←	4	4
106	CTS	→	5	5
107	DSR	→	6	6
102	SG	—	7	7
109	DCD	→	8	8
114	TCLK	→	15	15
115	RCLK	←	17	17
141	LP3	←	18	18
108.2	DTR	←	20	20
140	LP2	←	21	21
125	RI	→	22	22
112	SI	→	23	23
113	TCLK	←	24	24
142	TM	→	25	25
				Shield

Fig. A-1 LASAT asynchronous/synchronous data cable.

A.2.2 RS232 Asynchronous cable connections.

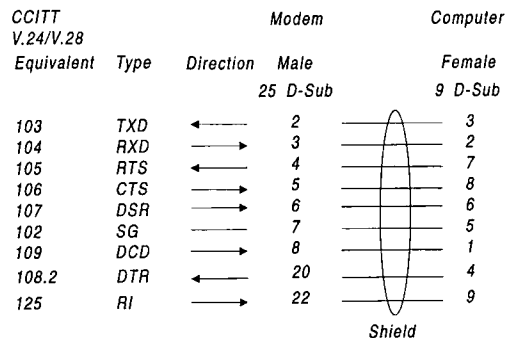


Fig. A-2 LASAT asynchronous data cable.

A.3 Decoding of bitrelated registers.

Table A-2. Decoding of bitrelated registers.

[illegible]

A.4 Result Codes.

Table A-3. Result Codes.

Short Form	Long Form	n Value in ATXn Command				
		0	1	2	3	4
0	OK	X	X	X	X	X
1	CONNECT	X	X	X	X	X
2	RING	X	X	X	X	X
3	NO CARRIER	X	X	X	X	X
4	ERROR	X	X	X	X	X
5	CONNECT 1200	1	X	X	X	X
6	NO DIALTONE	3	3	X	X	X
7	BUSY	3	3	3	X	X
8	NO ANSWER	X	X	X	X	X
9	CONNECT 0600	1	X	X	X	X
10	CONNECT 2400	1	X	X	X	X
11	CONNECT 4800	1	X	X	X	X
12	CONNECT 9600	1	X	X	X	X
13	CONNECT 7200	1	X	X	X	X
14	CONNECT 12000	1	X	X	X	X
15	CONNECT 14400	1	X	X	X	X
16	CONNECT 19200	1	X	X	X	X
17	CONNECT 38400	1	X	X	X	X
18	CONNECT 57600	1	X	X	X	X
22	CONNECT 1200TX/75RX	1	X	X	X	X
23	CONNECT 75TX/1200RX	1	X	X	X	X
24	DELAYED	4	4	4	4	X
32	BLACKLISTED	4	4	4	4	X

Table A-3. Result Codes (cont'd)

Short Form	Long Form	n Value in ATXn Command					
		0	1	2	3	4	
40	CARRIER 300						X
44	CARRIER 1200/75						X
45	CARRIER 75/1200						X
46	CARRIER 1200						X
47	CARRIER 2400						X
48	CARRIER 4800						X
49	CARRIER 7200						X
50	CARRIER 9600						X
51	CARRIER 12000						X
52	CARRIER 14400						X
66	COMPRESSION: CLASS 5						X
67	COMPRESSION: V.42 bis						X
69	COMPRESSION: NONE						X
76	PROTOCOL: NONE						X
77	PROTOCOL: LAPM						X
80	PROTOCOL: ALT						X
81	PROTOCOL: ALT-CELLULAR						X
33	FAX	X	X	X	X	X	X
+F4	+FCERROR	X	X	X	X	X	X
35	DATA	X	X	X	X	X	X

Note:
An "X" in a column indicates that the message (either the long form if verbose, or the value only for short form) will be generated when that particular value of "n" (shown at the top of the column) has been selected by the use of ATXn. If the column is blank, then no message will be generated for that X option. A numeral indicates which less explicit message (verbose or short form) will be output for that X option.

A.5 Abbreviated Command Survey.

- A/ Re-execute command.
A Go off-hook and attempt to answer a call.
B0 Select V.22 connection at 1200 bps.
B1 Select Bell 212A connection at 1200 bps.
C1 Return OK message.
D Dial modifier.
E0 Turn off command echo.
E1 Turn on command echo.
F0 Select auto-detect mode (equivalent to N1).
F1 Select V.21 or Bell 103.
F2 Reserved.
F3 Select V.23 line modulation.
F4 Select V.22 or Bell 212A 1200 bps line speed.
F5 Select V.22bis 2400 line modulation.
F6 Select V.32bis or V.32 4800 line modulation.
F7 Select V.32bis 7200 line modulation.
F8 Select V.32bis or V.32 9600 line modulation.
F9 Select V.32bis 12000 line modulation.
F10 Select V.32bis 14400 line modulation.
H0 Initiate a hang-up sequence.
H1 If on-hook, go off-hook and enter command mode.
I0 Report product code.
I1 Report pre-computed checksum from ROM.
I2 Compute checksum and report status.
I3 Report firmware level.
I5 Report the country code number.
L0 Set lowest speaker volume.
L1 Set low speaker volume.
L2 Set medium speaker volume.
L3 Set high speaker volume.
M0 Turn speaker off.
M1 Turn speaker on during handshaking and turn speaker off while receiving carrier.
M2 Turn speaker off during handshaking and while receiving carrier.
M3 Turn speaker off during dialling and receiving carrier and turn speaker on during answering.

N0	Handshake only per S37 and Bn.
N1	Automode handshake.
O0	Go on-line.
O1	Go on-line and initiate a V.22bis retrain sequence.
P	Force pulse dialling.
Q0	Allow result codes to DTE.
Q1	Inhibit result codes to DTE.
Sn	Select S register as default.
Sn=v	Set S register n to value v.
Sn?	Return the value of S register n.
S=v	Set default S register to value v.
S?	Return the value of default S register.
T	Force DTMF dialling.
V0	Report short form (terse) result codes.
V1	Report long form (verbose) result codes.
W0	Report DTE speed in EC mode.
W1	Report line speed, EC protocol and DTE speed.
W2	Report DCE speed in EC mode.
X0	Report basic call progress result codes, i.e. OK, CONNECT, RING, NO CARRIER (also for busy, if enabled and dial tone not detected), NO ANSWER and ERROR.
X1	Report basic call progress result codes and connection speeds, i.e. OK, CONNECT, RING, NO CARRIER (also for busy, if enabled and dial tone not detected) NO ANSWER, CONNECT XXXX and ERROR.
X2	Report basic call progress result codes and connection speeds, i.e. OK, CONNECT, RING, NO CARRIER (also for busy, if enabled and dial tone not detected) NO ANSWER, CONNECT XXXX and ERROR.
X3	Report basic call progress result codes and connection rate, i.e. OK, CONNECT, RING, NO CARRIER, NO ANSWER, CONNECT XXXX, BUSY and ERROR.
X4	Report all call progress result codes and connection rate, i.e. OK, CONNECT, RING, NO CARRIER, NO ANSWER, CONNECT XXXX, BUSY, NO DIAL TONE and ERROR.
Y0	Disable long space disconnect before on-hook.
Y1	Enable long space disconnect before on-hook.
Z0	Restore stored profile 0 after warm reset.
Z1	Restore stored profile 1 after warm reset.
VA0	Set maximum block size in MNP to 64.

VA1	Set maximum block size in MNP to 128.
VA2	Set maximum block size in MNP to 192.
VA3	Set maximum block size in MNP to 256.
VBn	Send break of n (n = 1 to 9) durations of 100 ms (n = 3).
VF	Display all the telephone directory slots.
VG0	Disable modem to modem flow control.
VG1	Enable modem to modem flow control.
VJ0	Disable adjustment of DTE speed to match line speed.
VJ1	Enable adjustment of DTE speed to match line speed.
VKn	Controls break handling during three states: <i>When modem receives a break from the DTE:</i>
VK0	Enter on-line command mode, no break sent to the remote modem.
VK1	Clear buffers and send break to remote modem.
VK2	See VK0.
VK3	Send break to remote modem immediately.
VK4	See VK0
VK5	Send break to remote modem in sequence with transmitted data.
<i>When modem receives VB in on-line command state:</i>	
VK0,1	Clear buffers and send break to remote modem.
VK2,3	Send break to remote modem immediately.
VK4,5	Send break to remote modem in sequence with transmitted data.
<i>When modem receives break from the remote modem in normal mode:</i>	
VK0,1	Clear data buffers and send break to DTE.
VK2,3	Send break immediately to DTE.
VK4,5	Send break in sequence with received data to the DTE.
VL0	Use stream mode for MNP.
VL1	Use block mode for MNP.
VN0	Select normal speed buffered mode.
VN1	Select direct mode.
VN2	Select reliable link mode.
VN3	Select auto reliable mode.
VN4	Force LAPM mode.
VN5	Force MNP mode.
VS	Display active configuration of the modem.
W0	Disable V.23 split baud rate operation.
W1	Enable V.23 split baud rate operation.
&C0	Force RLSD active regardless of the carrier state.
&C1	Allow RLSD to follow the carrier state.

&D0 Interpret DTR ON-to-OFF transition per &Qn:
 &Q0, &Q5, &Q6 The modem ignores DTR.
 &Q1, &Q4 The modem hangs up.
 &Q2, &Q3 The modem hangs up.
 &D1 Interpret DTR ON-to-OFF transition per &Qn:
 &Q0, &Q1, &Q4,
 &Q5, &Q6 Asynchronous escape.
 &Q2, &Q3 The modem hangs up.
 &D2 Interpret DTR ON-to-OFF transition per &Qn:
 &Q0 through &Q6 The modem hangs up.
 &D3 Interpret DTR ON-to-OFF transition per &Qn:
 &Q0, &Q1, &Q4, The modem performs
 &Q5, &Q6 soft reset.
 &Q2, &Q3 The modem hangs up.
 &F0 Recall (restore) factory profile 0.
 &F1 Recall (restore) factory profile 1.
 &G0 Disable guard tone.
 &G1 Disable guard tone.
 &G2 Enable 1800 Hz guard tone.
 &J0 Set S register response only for compatibility.
 &J1 Set S register response only for compatibility.
 &K0 Disable DTE/DCE flow control.
 &K3 Enable RTS/CTS DTE/DCE flow control (modem).
 &K4 Enable XON/XOFF DTE/DCE flow control.
 &K5 Support transparent XON/XOFF DTE/DCE flow control.
 &K6 Enable RTS/CTS and XON/XOFF DTE/DCE flow control (fax).
 &L0 Select dial up line operation.
 &L1 Select leased line operation.
 &M0 Select direct asynchronous mode.
 &M1 Select sync connect with async off-line command mode.
 &M2 Select sync connect with async off-line command mode and enable DTR dialling of directory zero.
 &M3 Select sync connect with async off-line command mode and enable DTR to act as Talk/ Date switch.
 &P0 Set 10 pps pulse dial with 39%/61% make/ break.
 &P1 Set 10 pps pulse dial with 33%/67% make/ break.
 &P2 Set 20 pps pulse dial with 39%/61% make/ break.
 &P3 Set 20 pps pulse dial with 33%/67% make/ break.
 &Q0 Select direct asynchronous mode.

&Q1 Select sync connect with async off-line command mode.
 &Q2 Select sync connect with async off-line command mode and enable DTR dialling of directory zero.
 &Q3 Select sync connect with async off-line command mode and enable DTR to act as Talk/ Date switch.
 &Q4 Select Hayes autosync mode.
 &Q5 Modem negotiates an error corrected link.
 &Q6 Select asynchronous operation in normal mode.
 &R0 CTS tracks RTS (sync) or acts per V.25 (async).
 &R1 CTS is always active (sync) or drops during flow control (async).
 &S0 DSR is always active.
 &S1 DSR acts per V.25.
 &T0 Terminate any test in progress.
 &T1 Initiate local analog loopback.
 &T2 Returns ERROR result code.
 &T3 Initiate local digital loopback.
 &T4 Allow remote digital loopback.
 &T5 Disallow remote digital loopback request.
 &T6 Request an RDL without self-test.
 &T7 Request an RDL with self-test.
 &T8 Initiate local analog loop with self-test.
 &V Display current configurations.
 This command might not be available for some countries due to PTT restrictions.
 &W0 Store the active profile in NVRAM profile 0.
 &W1 Store the active profile in NVRAM profile 1.
 &X0 Select internal timing for the transmit clock.
 &X1 Select external timing for the transmit clock.
 &X2 Select slave receive timing for the transmit clock.
 &Y0 Recall stored profile 0 upon power up.
 &Y1 Recall stored profile 1 upon power up.
 &Zn=x Store dial string x (to 40) to location n (0 to 19).
 %C0 Disable data compression.
 %C1 Enable MNP 5 data compression.
 %C2 Enable V.42bis data compression.
 %C3 Enable both V.42bis and MNP 5 compression.
 %E0 Disable line quality monitor and auto retrain.
 %E1 Enable line quality monitor and auto retrain.
 %F1 Select 75Tx/1200Rx when viewdata is select- ed.

%F2 Select 1200Tx/75Rx when viewdata is selected.
 %F3 Select V.23 half-duplex.
 %L Return received line signal level in dBm.
 %Q Report the line signal quality.
 *B Display list of delayed numbers.
 *C Store remote configuration password.
 *D Display list of delayed numbers.
 *E End remote configuration.
 *H0 Select MNP 10 link negotiation at highest rate.
 *H1 Select MNP 10 link negotiation at 1200 bps.
 *H2 Select MNP 10 link negotiation at 4800 bps.
 *L Display list of callback numbers.
 *NCnn Change country to one of eight in NVRAM.
 *Pn:<password>:<callback no.>
 Store and delete a password/callback number.
 *R Request remote configuration in MNP.
 *Z0 Use dial code 0 for pulse dial.
 *Z1 Use dial code 1 for pulse dial.
 -K0 Disable MNP 10 extended services.
 -K1 Enable MNP 10 extended services.
 -Q0 Enable fallback to V.22/V.22bis.
 -Q1 Disable fallback to V.22/V.22bis.
)M0 Disable MNP 10 link negotiation power adjustment.
)M1 Enable MNP 10 link negotiation power adjustment.

AT Commands - Fax

+FCLASS= Service class.
 +FCLASS=0 Data modem operation.
 +FCLASS=1 Fax Class 1 modem operation.
 +FCLASS=2 Fax Class 2 modem operation.

V.25bis Commands

Select V.25bis command set with the AT command:

ATS80=32Z

Return to AT command set with the V.25bis command:

CNLS80=0Z

CIC Connect incoming call.
 CNL Execute AT command (if permitted).
 CRI Call request with number/identification.
 CRN Call request with number.
 CRS Call request with memory address.
 DIC Disregard incoming call.
 PRI Programme identification.
 PRN Programme normal.
 RLD Request list of delayed call numbers.
 RLF Request list of forbidden call numbers.
 RLI Request list of identification numbers.
 RLN Request stored number list (dial strings).

Note:

It is **not** allowed to use the commands ATX0, ATX1 and ATX2 in Sweden.

INDEX:

A

Abbreviated command survey A-31
 Active configuration 2-10
 Analog loop 4-1
 Asynchronous/synchronous cable connections A-25
 Asynchronous cable connections A-26
 AT Command Format 3-1
 Auto Answer 2-8, 3-66
 Auto Dial 2-2
 Auto-Reliable 5-7
 Automatic answer 3-70
 Autosync 6-4
 AT commands:
 A/ (re-execute command) 3-3
 AT? (read selected s-register) 3-3
 AT=x (write to selected s-register) 3-3
 A (answer) 3-3
 B (OCITT or Bell) 3-4
 C (carrier ctrl) 3-4
 D (dial) 3-4, 3-69
 E 3-8
 EO (command echo) 3-8
 F (slct line modulation) 3-8
 H (disconnect (hang-up)) 3-10
 I (identification) 3-10
 L (speaker volume) 3-11
 M (speaker ctrl) 3-11
 N (automode enable) 3-11
 O (return to on-line data mode) 3-12
 P (set pulse dial default) 3-12
 Q (quiet results codes ctrl) 3-13
 Sn (read/write s-register) 3-13
 T (set tone dial default) 3-14
 V (result code form) 3-14
 W (error correction msg ctrl) 3-14
 X (extended result codes) 3-15
 Y (long space disconnect) 3-16
 Z (soft reset and restore profile) . . . 3-16
 VA (max MNP block size) 3-17
 VB (tx break to remote) 3-17
 VF (display telephone directory) . . . 3-17
 VG (modem-to-modem flow ctrl (xon/xoff)) 3-18
 VJ (enable DTE auto rate adj) 3-18

VK (break ctrl) 3-18
 VL (MNP block/stream mode slct) 3-20
 VN (operating mode) 3-20
 VS (report active config) 3-21
 VW (split-speed operation) 3-21
 &C (RLSD (DCD) option) 3-21
 &D (DTR option) 3-22
 &F (restore factory config (profile)) 3-23
 &G (slct guard tone) 3-23
 &J (telephone jack ctrl) 3-24
 &K (flow ctrl) 3-24
 &L (leased line operation) 3-24
 &M (async/sync mode selection) 3-25
 &P (slct pulse dial make/break ratio) 3-25
 &Q (sync/async mode) 3-26
 &R (RTS/CTS option) 3-26
 &S (DSR override) 3-27
 &T (test and diagnostics) 3-27, 3-32
 &V (display current config and stored profiles) 3-28
 &W (store current config) 3-29
 &X (sync clock source) 3-29
 &Y (default reset profile) 3-29
 &Zn=x (store telephone no.) 3-30
 %C (enable/disable data compression) 3-30
 %E (enable/disable line quality) 3-30
 %F (split-speed dir. slct) 3-31
 %L (line signal level) 3-31
 %M (AUXCTL output line ctrl) 3-31
 %Q (line signal quality) 3-32
 *B (display blacklisted nos) 3-33
 *C (remote config password) 2-25, 3-34
 *D (display delayed numbers) 3-34
 *E (exit remote config mode) 2-25, 2-27, 3-34
 *H (link negotiation speed) 3-35
 *L (display secure access (callback) directory) 3-35
 *NCnn (country slct) 3-35
 *P (store callback password) 3-36
 *Pn: 2-28

LASAT 144-series modems

*R (request remote config mode)	2-24, 3-37	+FRS (receive silence)	3-56
*X	2-27	+FTH (tx data with HDLC framing)	3-58
-K (MNP extended services)	3-37	+FTM (fax data transmission)	3-53, 3-56
-Q (enable fallback to V.22 bis/v.22)	3-37	+FTS (stop transmission and wait)	3-56
!M (enable cellular power lvl adj)	3-38	+FTSI: (Report the tx station ID)	3-81
+FAA (answer parameter)	3-90		
+FAE (data/fax auto answer)	3-56	B	
+FAXERR (T.30 session error report)	3-89	Bell	3-4
+FBOR (data bit order)	3-89	Blacklisted numbers	3-33
+FBUF? (buffer size)	3-90	Block size	5-2
+FCFR (indicate confirmation to receive)	3-81	Break	3-18, A-20
+FCO (facsimile connection resp.)	3-80	BSC	3-40
+FCQ (copy quality checking)	3-88	Buffer overflow	3-54
+FCR (capability to receive)	3-87	C	
+FCSL: (report the called station ID)	3-81	Callback	3-36
+FDCC (DCE capabilities parameters)	3-84	CCITT T.50	3-62
+FDCS (current session result parameters)	3-80, 3-85	CCITT V.42	5-1
+FDIS (current sessions capabilities)	3-80, 3-84	CCITT V.42bis	5-1
+FDR (begin or continue phase C receive data)	3-75	CIC	2-22, 3-42
+FDT (data transmission)	3-71	CNL	3-46, 3-46
+FET: (post page msg resp.)	3-82	CNX	2-22
+FHNG: (call termination with status)	3-83	Constant Rate	2-9
+FK (session termination)	3-78	Country slct	3-35
+FLID (local ID string)	3-86	CRI	3-42
+FMDL? (identify product model)	3-68	CRN	2-21, 3-43
+FMFR? (request manufacturer identification)	3-68	CRS	3-43
+FPHCTO (DTE phase C resp. time-out)	3-88	D	
+FPTS: (tx page transfer status)	3-81, 3-82, 3-87	Data Compression	5-1
+FREVE? (identify product revision)	3-68	Decoding of bitrelated registers	A-27
+FRH (receive data with HDLC framing)	3-58	Delayed call	3-47
+FRM (fax data reception)	3-53, 3-57	Delayed numbers	3-34

Dial Back	2-28, 2-29
Dial modifiers	3-5
Dialling	2-5
DIALTONE	2-2
DIC	2-23, 3-43
Digital loop	4-2
Disconnect	2-6
DTMF Dial	2-3
DTR Dial	2-15, 6-2
E	
Echo	2-11

Index.

Error Correction	5-1	Leased line	3-24
Escape Code Sequence	3-2	Line quality monitor	3-30
Example 4.1 (AT &T3)	4-4	Line modulation	3-8
Example 4.2 (AT &T8)	4-5	Long space disconnect	3-16
Example 4.3 (AT &T6)	4-6	Loudspeaker	2-12, 3-11
Example 4.4 (AT &T7)	4-7		
Example 4.5 (AT &T3)	4-9	M	
Extended Command Syntax	3-62	Manual Answer	2-8
		Manual Call	2-15
F		Manual Dial	2-5
Factory Defaults	A-1	Mixed Operation	2-17
Factory configuration	2-10	MNP	2-20
Fax Class 1 Commands	3-48, 3-49	MNP2-5	5-2
Fax	3-53	MNP5	5-1
Fax Answering	3-49	MNP10	5-6
Fax Class 1 Calling Sequence	3-60	Monitor	2-12
Fax class 2 receive two pages	3-93		
Fax class 2 send two pages	3-92	N	
Fax Class 1 Answering Sequence	3-61	Number Sending Facility	2-13
Fax Class 2 Commands	3-62		
Fax Control	3-50	P	
Fax I/O	3-48	PABX	2-4
Fax Mode	3-48	PRI	3-44
Fax Origination	3-49	PRN	3-44
Fax Serial Port	3-65	Pulse Dial	2-3, 3-12
Fax Syntax	3-62		
Flash	2-4, 3-7	R	
Flash Dial Modifier Time	A-13	Rate Converting	5-3
Flow control	2-9, 3-24, 3-65, 5-4	Re-tx	5-2
Frame abort sequence	3-52	Reception	3-53
Function	2-12	Remote Access Escape Character	A-23
		Remote config	2-23, 2-26, 3-34, 3-37
G		Remote Digital Loop, Accept	4-7
Group 3	3-66	Remote Digital Loop, Reject	4-8
Guard tone	3-23	Remote escape sequence	2-26
		Result Code	2-11, A-29
H		RLD	3-44
Hardware flow control	2-9	RLF	3-44
HDLC	3-39, 3-50, 3-58	RLI	3-45
		RLN	3-45
I		S	
Identification	2-13	S Register Summary	A-2
Introduction	1-1	S0	A-4
ISO 2111	3-65	S1	A-4
ISO 646 character set	3-62	S2	A-4
		S3	A-4
L		S4	A-4
LAP-M	2-20		

LASAT 144-series modems

S5	A-5
S6	A-5
S7	A-5
S8	A-6
S9	A-6
S10	A-6
S12	A-6
S14	A-7
S16	A-8
S18	A-8
S21	A-9
S22	A-10
S23	A-11
S24	A-11
S25	A-12
S26	A-12
S27	A-12
S28	A-13
S29	A-13
S30	A-14
S31	A-14
S32	A-14
S33	A-14
S36	A-15
S37	A-16
S38	A-16
S39	A-17
S40	A-17
S41	A-18
S46	A-18
S48	A-19
S80	A-19
S82	A-20
S86	A-20
S91	A-21
S92	A-21
S95	A-22
S99	A-22
S202	A-23
Software flow control	2-9
Speed buffer	3-65
Split-Speed	3-21, 3-31
Stored Number	2-5
Store passwords	2-2
Store telephone number	2-28, 3-30
Synchronous clock	3-29
Synchronous clock signal	6-1
Synchronous connection	2-14

T

T.30	3-63, 3-66, 3-68, 3-73, 3-75, 3-89
T4	3-63
Termination of Test	4-3
Test	2-20, 5-5
Test diagnostics	3-27
Tone dial	3-14
Transmission	3-53

V

V.25bis	2-21, 3-38
V.25bis command interpreter	2-21
V.25 Bis Indications	3-46
V.42	2-18
V.42 Negotiation	A-19

