

**Agilent**

## **CDMA Mobile Station Test Set**

Product Note

### **Using the 8924C Test Set's CDMA Logging Functions**

8924C Logging Functions, Rev. E (7/13/98) for Firmware  
Rev. A.06.15 or greater

This document describes the CDMA protocol logging function available in the Agilent Technologies 8924C CDMA Mobile Station Test Set. The CDMA protocol logging feature allows the capture of all of the IS-95A over-the-air messages sent by the 8924C (on the paging channel or traffic channel) and received by the 8924C from a connected CDMA mobile phone (on the access channel or traffic channel). Capturing these logs requires a number of items not supplied with the 8924C. These required items are identified in this document. This function only provides logging capability. Data insertion (for the forward link) or new message insertion into the protocol stream is not possible with the 8924C. A special mode does allow the display of the raw data sent and received by the 8924C.

The logging function is an artifact of system development tools used by Agilent Technologies. The logging function is a low-level tool designed to aid the advanced user in debugging new phone designs or qualifying the operation of new mobile phones. Operation and setting changes made using the information contained in this document can effect system operation. Any operation changes made using these techniques are the responsibility of the user. Agilent Technologies makes no claim or warranty of proper operation or fitness of use when the user has altered the operation of the unit using these techniques. While the data provided by the 8924C is preformatted into English messages, some filtering of internal 8924C data from protocol messages must be performed by the user. In addition to the logging functions, this document also provides information on special control modes that are user accessible from the logging ports.

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## Hardware & Software Requirements

Using the protocol logging functions of the 8924C requires a number of specific hardware and software items not supplied directly by Agilent Technologies. It is the user's responsibility to acquire those items not provided by Agilent Technologies in order to successfully log CDMA protocol messages. The hardware and software items specified in this document have been tested by Agilent Technologies and operate as described herein. Failure to follow these guidelines may result in unsatisfactory performance.

Agilent Technologies does not recommend substitutions of other items not specified in this document. While substitutions may work, Agilent Technologies does not make any claims of suitability as to the form and/or function of such substitutions.

### Hardware Requirements

Five pieces of hardware are required to access the protocol logging functions on the 8924C:

1. An industry standard PC-compatible computer
2. A null-modem serial cable, 6 feet or shorter (9-pin female D-connectors on both ends, e.g., Agilent part number 5182-4794 or F1047-80002)
3. An 8924C CDMA Mobile Station Test Set
4. A 37-pin D-connector to two 9-pin and one 15-pin D-connector breakout adapter (shipped standard with each 8924C; Agilent part number 08924-61044)
5. A CDMA phone

The PC-computer is used as a terminal to display information sent from the 8924C and to send single keystroke commands to the 8924C. The null modem cable provides the serial data link from the 8924C to the computer. The CDMA phone and 8924C are required since most protocol activities involve registering or establishing a link with a CDMA phone. The connector adapter is used to break out the two 9-pin serial ports that are used for logging on the 8924C's rear panel 37-pin subminiature D-connector (part number 08924-61044). This adapter is shipped as standard equipment with the 8924C.

### PC Computer Requirements

Since the serial connection from the 8924C operates at very high speed, the performance level of the PC-compatible computer is vital. At a minimum, the computer must have the following characteristics:

- 486, 33 MHz microprocessor
- 8 MB of RAM
- 30 MB of free hard disk space

- VGA graphics card and color monitor
- One free serial port equipped with a buffered 16550 UART

The importance of the buffered UART for the serial port should not be ignored. The 16550 UART provides 16 bytes of both transmit and receive buffering. The buffering allows communications to proceed even if the processor is busy and cannot immediately handle the serial port interrupt requests. A faster processor such as a 586 100-MHz microprocessor will ensure accurate reception of data and reduce the likelihood of missed characters sent from the 8924C.

The null-modem cable is a readily available standard serial cable. The actual cable connections required will depend on the serial port connector found on the PC that is used. See Figures 1 and 2. The connector that mates to the 8924C must be a 9-pin male subminiature D connector. The end that connects to the computer serial port will most likely be either a 9-pin female subminiature D connector (found on most recent vintage computers) or a 25-pin subminiature D connector. The null modem cable reverses pins 2 and 3 to allow proper transmission and reception between the 8924C's serial port and the PC's serial port.

### Software Requirements

In addition to a number of hardware items, CDMA protocol logging with the 8924C also requires a communications software package that will run on the PC. Because of the high speed used by the 8924C for protocol logging, the communications software must be capable of the following:

- Handle a null modem serial connection
- Support a baud rate of 115 K
- Emulate a VT 100 terminal

The high data rate eliminates the use of communications packages for MS Windows® 3.X or even running MS-DOS® based packages running under windows.

Agilent Technologies has tested and recommends PROCOMM PLUS version 2.01 for MS-DOS (from Datastorm Technologies Inc.) as the communications package of choice. PROCOMM PLUS meets these requirements and provides session logging that simplifies the capture and later analysis of captured protocol logs. At a minimum, PROCOMM PLUS must be run with MS-DOS version 2.0 or later.

Agilent Technologies recommends that PROCOMM PLUS be run with MS-DOS version 6.22. With the introduction of Windows 95® and its serial communications support, it is now possible to use new 32-bit communications software packages.

Agilent Technologies has verified that the HyperTerminal program that comes with Windows 95 works in this application. Those who use HyperTerminal under Windows 95 should use PC compatible hardware that can handle the additional requirements of the Windows 95 environment. Agilent Technologies recommends a PC that has a minimum 486 66-MHz microprocessor and 16 Mbytes of RAM for those using Windows 95.

For HyperTerminal setup information, see the attached Appendix A.

## Getting Started

Once you have obtained the required items, the next step is to properly connect the computer to the 8924C. While the exact cable types are known for the connections from the 8924C, the exact type of serial connector for the end terminating at the PC will be specific to the PC used. Two possible types are either a 9-pin subminiature D connector (used by most newer PCs) or the older style 25-pin serial connector. Please verify the type of serial connector required on the PC you plan to use for protocol logging before obtaining the cable.

## Connecting the Pieces

In order to log the protocol messaging, you must connect one of the two serial logging ports on the 8924C to the PC's serial port. This connection is made using the breakout adapter (supplied with the 8924C, P/N 08924-61044) and the null modem cable (not supplied with the 8924C).

The breakout adapter attaches to the 37-pin D connector on the 8924C's rear panel. This connector is labeled as **CELLSITE/TRIGGERS**. From the factory, each new 8924C is shipped with a metal cover plate that is attached to the 37-pin D connector. The cover must be removed to attach the breakout adapter.

The other end of the breakout adapter is split into three ribbon cables each with its own connector. Two of the three ribbon cables are terminated with 9-pin male subminiature D connectors. The third ribbon cable is terminated with a 15-pin female subminiature D connector.

The signals on the 15-pin connector include all of the CDMA frame clocks provided by the 8924C and several trigger outputs. The two 9-pin connectors are the outputs for the serial logging functions in the 8924C.

### IMPORTANT - Null Modem Cable

**Considerations:** Because the logging ports on the 8924C are very high speed, the null modem serial cable's internal crosstalk level is **CRITICAL!** If a cable is attached that has high crosstalk or is left unterminated, the high speed data output by the 8924C can appear on the input to these logging ports causing the 8924C to behave erratically. If this happens, the 8924C will not be able to connect CDMA phone calls and can crash. Use only a high quality cable (6 feet or less in length) and always have it plugged into a PC serial port if the cable is attached to the 8924C.

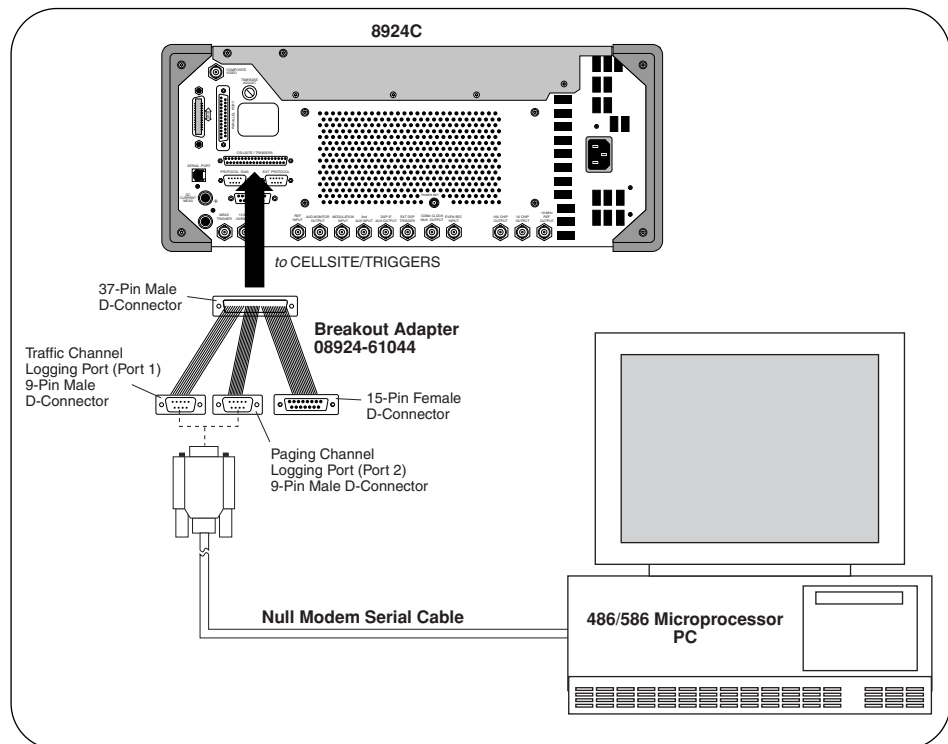


Figure 1

If you wish to make your own cable, Figure 2 shows how to make a 6-foot cable using 9-wire ribbon cable.

The first 9-pin port outputs all signaling that occurs on the forward and reverse traffic channels. The second 9-pin port provides all signaling functions that occur on the paging channel and access channel.

To complete the connection as shown in Figure 1, follow these steps:

1. Connect the breakout adapter to the CELLSITE/TRIGGERS port on the 8924C.
2. Select the desired port by connecting the null modem cable to either of the two 9-pin ports on the breakout adapter (first port for traffic channel, second port for paging/access channels).
3. Connect the null modem cable to the PC's serial port.

## Configuring the Terminal Emulation Software

The next step is to configure the terminal emulation software properly to interface with the serial ports from the 8924C. There are numerous software packages that can be used for terminal emulation. HyperTerminal and PROCOMM PLUS are two examples. See Appendix A for HyperTerminal setup information, and Appendix B for PROCOMM PLUS setup information.

After entering the software, terminal options and port settings for CDMA protocol logging will need modifying. Terminal options and port settings will need to be set regardless of the software or setup being used.

### Terminal Options

- Terminal Emulation: VT100
- Full Duplex

### Port Settings

- Baud Rate: 115200 bps
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

## Verifying the setup

At this point we can now verify that the setup is properly connected and working, see Figure 1. To verify the setup, follow these steps:

1. Power on the 8924C, wait until entire power-on cycle completes.
2. Make sure that the null-modem cable is connected to the PC's serial port and breakout adapter (either port can be used).
3. Verify that the breakout adapter is connected to the 8924C rear panel CELLSITE/TRIGGERS port.
4. Start the terminal emulation program.
5. Press the ENTER key on the PC keyboard.
6. If everything is properly setup, you should see a prompt echoed from the 8924C to the PC's screen. You will see a different message depending on which of the two serial ports you are connected to: "DCS1>" for port 1 or "DCS2>" for port 2.

If you see the prompt each time you press the ENTER key, the setup is working properly. You are now ready to perform CDMA protocol logging. If you get a prompt, but the text is garbled, make sure that the terminal emulation program is set to emulate a VT100 terminal.

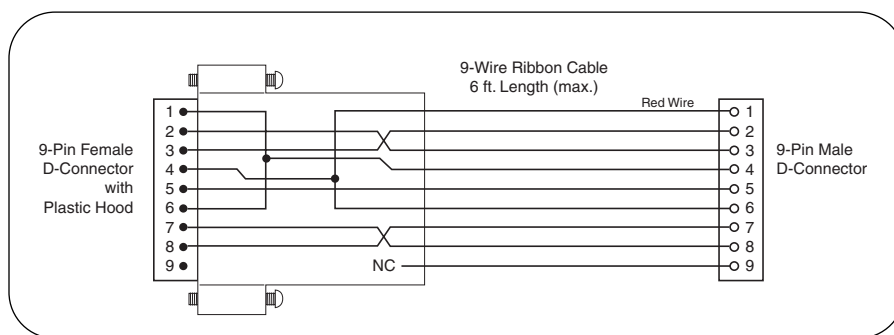


Figure 2. Null Mode Cable

## Separating Internal Data from Protocol Messages

Although the protocol logging output of the 8924C formats signaling messages into clearly documented English text, some separation of internal messages must be performed. There are three types of character data that the 8924C outputs through logging serial ports:

- Internal 8924C control messages
- CDMA protocol messages
- Real-time traffic channel and power control sub-channel information

The 8924C makes no attempt to separate any of these data items from each other, but rather outputs any of the three data types in a serial fashion as they occur. It is up to the user to extract the useful items from the serial logging stream of data.

## CDMA Protocol Messages

CDMA protocol messages provide most of the information helpful for users of the 8924C. The protocol messages also begin with an easily recognizable text header.

CDMA protocol messages are always labeled with a text header that starts with four underline characters “\_\_\_\_”, followed by a textual description of the message, and then followed by another set of four underline characters “\_\_\_\_\_”. The textual description always starts with the direction that the message came from.

The word “Forward” indicates that the message was sent by the 8924C to the mobile on the forward link. The word “Reverse” indicates that the message was sent from the CDMA mobile to the 8924C on the reverse link. The parameters following the header show the various IS-95A parameters that were sent with the protocol message.

```
<----- Protocol to CellSite IPC Message Contents ----->
c0 00 66 04 00 03 03 b4

                                OR

<----- CellSite to Protocol IPC Message Contents ----->
18 00 00 00 58 2b c6 3d d0 01 07 04 01 00 15 00
```

## Internal 8924C Control Messages

The internal 8924C control messages contain proprietary information pertaining to the internal operation of the unit. These messages provide no useful information to the user and no documentation of these will be provided. These internal control messages are easy to identify. All internal control messages start with a specific textual header:

```
____Reverse Traffic Order Message ____
Ack_seq = 0x7
Msg_seq = 0x0
Acknowledge is required
Order Message - Connect Order(0x18)
ADD_RECORD_LEN = 0
```

Notice that all internal control messages begin with the “<” followed by a number of dashes “---”, then a textual description followed by more dashes “---”, and finally the “>” character. Any messages starting with this type of header can be safely ignored.



## Paging Channel Logging

All over-the-air messages that are sent by the 8924C through the paging channel to a specific mobile are available on logging Serial Port 2 (from the breakout adapter). Several of the continuously repeated messages on the paging channel such as the System Parameters Message, Access Channel Parameters Message, Channel List Message, Extended System Parameters Message, and Extended Neighbor List Message are NOT displayed in real-time by the protocol logging functions. However, the contents of these messages are viewable using specific commands discussed later in this paper. Messages received on the access channel are also logged on Serial Port 2. The next section will review a few of the messages that can be examined on Serial Port 2.

## Registration Message

The registration message is transmitted to the 8924C on the access channel. Access channel information is displayed only on the second serial logging port. When a CDMA phone sends a Reverse Registration Message on the access channel, a message similar to the following will be sent from the 8924C to the logging PC:

```
____ Access Channel Rev Registration Msg ____
Preamble Length      = 196250 uSec
Earliest PN Offset   = 37
Ack Seq Number       = 7
Message Seq Number   = 0
Acknowledge is required
Valid Ack            = 0
Ack Type             = 0
MSID Type            = 3
MSID Length          = 9
ESN Length           = 4
Electronic Serial # = 0x000000 9F22C690
IMSI Length          = 5
IMSI Class           = 0
IMSI Class 0 Type    = 0
IMSI_S               = 0x1 F2CA8CB9 (509-921-3296)
Registration Type    = 0x1 : Power up
Slot Cycle Index     = 0
Protocol Revision    = 3
SCM                  = 0x6A
Mobile Terminated Calls Accepted
```

The registration message contains all of the information required to make a CDMA phone call. In the example above, the registration type indicates that this registration was a power-up registration. Other important data found in these messages includes the mobile's ESN, IMSI Length, IMSI Class, IMSI Class Type, IMSI\_S, Slot Cycle Index, Protocol Revision, and Station Class Mark. This example was generated from a TSB-74 revision phone.

If IS-95-0 protocol is used, MIN1 and MIN 2 parameters replace the IMSI. Most of this information is already decoded and available from the front panel user interface or through GPIB with the exception of the protocol revision supported by the phone.

## Forward Page Message

Whenever the base station pages a mobile station, it sends a paging order message output over the paging channel. This message is specifically addressed to a single mobile station. The example below is a TSB-74 page message as logged by the 8924C:

```
____ General Page Message ____
slotted           = 1
slot_cycle_index = 0
PAGE_CLASS       = 0
PAGE_SUBCLASS    = 0
MSG_SEQ          = 1
IMSI_S           = 0x1 F2CA8CB9 (509-921-3296)
SPECIAL_SERVICE = 1
SERVICE_OPTION  = 0x9
MON: Raw Paging frame -
Paging message ID = 17, Number of bits = 136
11 11 18 0C 00 02 F9 65 46 5C C0 02 40 2F 09 9D A6 0
```

## Access Channel Reverse Page Response Message

```
____ Access Channel Rev Page Rsp Msg ____
Preamble Length   = 105000 uSec
Earliest PN Offset = 0x3D
Paging Sequence Num = 0x7
Message Number    = 0x6
Acknowledge is required
Paging Acknowledge = 0x1
Paging Address Data = 0x0
Mobile ID part 1   = 0xCA8ED7
Mobile ID part 2   = 0x1F2
Electronic Serial # = 0x81234159
Authentication is not required
Authentication Data = 0xC2886010
Random Challenge   = 0x10
Call History Param = 0x42
The mobile requested service option 1
```

The example below is a mobile station's response to a page from an 8924C:



## Access Channel Reverse Origination Message

When a mobile originates a call, it sends an access channel reverse origination message to the base station. If the 8924C receives such a message, it will log the message as follows:

```
____ Access Channel Rev Origination Msg ____
Preamble Length      = 196250 uSec
Earliest PN Offset   = 9
Ack Seq Number       = 1
Message Seq Number   = 2
Acknowledge is required
Valid Ack            = 0
Ack Type              = 2
MSID Type            = 3
MSID Length          = 9
ESN Length           = 4
Electronic Serial #  = 0x000000 9F22C690
IMSI Length          = 5
IMSI Class           = 0
IMSI Class 0 Type    = 0
IMSI_S               = 0x1 F2CA8CB9 (509-921-3296)
Mobile Terminated Calls Accepted
Slot Cycle Index     = 0
Protocol Revision    = 3
Ext_SCM              = 58
Slotted Mode         = 1
Requested Mode        = Either CDMA or wide analog only.
Special Service      = 1
Service Option       = 32768
Privacy Mode         = 0
Digit Mode           = DTMF
Number type          = Invalid type (0x3A).
Number plan          = Invalid type (0x63).
More fields          = 0x0
Number of digits     = 0xC
Digits               = 1234567890*#
Narrow Analog Cpbl  = 0x0
```

## Channel Assignment Message

When the base station is ready to complete the call processing and begin operation on a traffic channel, it sends a traffic channel assignment message on the paging channel to the mobile station. This message will be logged on Serial Port 2 in the following format:

```
____ Paging Traffic Channel Assignment Message ____
slotted                = 0
slot_cycle_index      = 0
ACK_SEQ               = 1
MSG_SEQ               = 2
ACK_REQ               = 0
VALID_ACK             = 1
ADDR_TYPE             = 2
ADDR_LEN              = 5
imsi_len              = 5
IMSI_CLASS            = 0
IMSI Class 0 Type=    0
IMSI_S                = 0x1 F2CA8CB9 (509-921-3296)
ASSIGN_MODE           = 4
FREQ_INCL             = 0
CODE_CHAN             = 8
CDMA_FREQ             = 0
FRAME_OFFSET          = 0
ENCRYPT_MODE           = 0
GRANTED_MODE          = 2
BAND_CLASS            = 0
```

## Using the Control Modes on Logging Port 2

A number of very useful control modes are available for special applications using the PC as a control device. Typing single characters on the PC keyboard (once the logging connection has been activated) activates these control modes.

Different commands are available on the two logging ports. On either logging port, simply type the ? character (Shift key, then the / key) to view a menu of the available commands. For clarity, make sure that a CDMA call is not active when you request the control menu. When the ? is typed while logging on Port 2, the 8924C will display the following screen on the PC:

```
All commands are a single character.  A carriage return is not
required.  Any characters not interpreted as a command will simply
be echoed.  Case is ignored.
```

- a - Displays the (A)ccess Channel parameters.
- b - Information on (B)uffer pools used in the system.
- c - Displays CDMA (C)hannel parameters.
- f - Starts the (F)lash programming subsystem.
- i - Displays the Wr(i)te only CSM register values .
- m - Displays the (M)onitored parameters on the Access Channel.
- o - Toggles log of (O)verhead messages on the Paging Channel.
- p - Displays the (P)aging Channel parameters.
- q - Displays the (Q)uery CellSite Status value.
- s - Displays the (S)ystem overhead message parameters.
- t - Displays the (T)ime, i.e., System Time.
- u - Displays the Q(U)ueue information.
- v - Firmware & CPU (V)ersion information.
- w - Displays the (W)rite Program RAM Status Flag.
- z - Locks the Serial input.
- . - (Period) Toggles display of Status Request Messages.
- ? - Gives this help screen.

## Command Descriptions

The following section describes each of the control mode commands and gives example results of using them:

- 'a' Pressing the 'a' key causes the 8924C to display the active parameters for the access channel. The logging PC displays a screen similar to the following:

```
Access channel parameters:
CS_ACC_CHAN(300:0x12C) = 0
CS_NOM_PWR(301:0x12D) = 0
CS_INIT_PWR(302:0x12E) = 0
CS_PWR_STEP(303:0x12F) = 0
CS_NUM_STEP(304:0x130) = 4
CS_MAX_CAP_SZ(305:0x131) = 7
CS_PAM_SZ(306:0x132) = 10
CS_PSIST0_9(307:0x133) = 0
CS_PSIST10(308:0x134) = 0
CS_PSIST11(309:0x135) = 0
CS_PSIST12(310:0x136) = 0
CS_PSIST13(311:0x137) = 0
CS_PSIST14(312:0x138) = 0
CS_PSIST15(313:0x139) = 0
CS_MSG_PSIST(314:0x13A) = 0
CS_REG_PSIST(315:0x13B) = 0
CS_PROBE_PN_RAN(316:0x13C) = 0
CS_ACC_TMO(317:0x13D) = 5
CS_PROBE_BKOFF(318:0x13E) = 0
CS_BKOFF(319:0x13F) = 0
CS_MAX_REQ_SEQ(320:0x140) = 1
CS_AUTH(322:0x142) = 0
CS_RAND(323:0x143) = 0
```

- 'b' This is a special command for internal Agilent Technologies use only. It provides no useful information to the user about the performance of the CDMA mobile station.
- 'c' Pressing the 'c' key causes the 8924C to display the current parameters for all of the CDMA channels. This information is directly controllable from the 8924C's front panel or GPIB user interface. Therefore the 'c' command duplicates the display function for CDMA channel parameters. When this command is issued, the logging PC displays information similar to the following:

```
CDMA Channel Parameters:
Cellsite Protocol      = IS-95A
PN Offset of Sector A = 12, Sector B = 36
Walsh Code of Pilot B = 0, Paging A = 1,
                      OCNS A = 17, OCNS B = 40
Status of Pilot B     = OFF, Paging A = ON, OCNS A = ON,
                      OCNS B = OFF, Access A = ON
```

- 'f' CAUTION: The 'f' special command is for internal Agilent Technologies use only. Misuse of this command can result in the destruction of the 8924C firmware causing the unit to not operate. This command should only be used if you are directed to do so by a Agilent Technologies' service center.
- 'i' Displays the write-only parameters currently set into the CSM™ chips on the Digital Cellsite 2 board. The 'i' special command is for internal Agilent Technologies use only. It provides no useful information to the user about the performance of the CDMA mobile station. Issuing this command does not alter the state of the instrument and therefore cannot cause problems.
- 'm' The 'm' special command displays the monitored parameters on the Access Channel. If the 8924C detects access probes, this command shows if the information was good or bad through the message CRC counters.

```
MON: Access Parameters follow.  
Slot count..... 175  
Preamble detected count.... 0  
Preamble detected late count 0  
Search failed count..... 176  
Search failed late count.... 0  
Good message CRC count..... 0  
Bad message CRC count..... 0  
  
MON: Decoder Driver parameters follow.  
decoder_int_count..... 0  
decoder_int_timeout_count.. 0  
frames_generated_count..... 3685
```

'o' The 'o' special command toggles the logging of the paging channel overhead messages. When active (the default is inactive), this command causes every paging channel overhead message to be logged. To determine what each logged overhead message is, an ID number is displayed. These numbers conform to the ID numbers found in the air interface standards. For example, ID=1 is the system parameters message. The number of transmitted bits in each message is also displayed. The raw hexadecimal data for each message follows the number of bits.

**IMPORTANT:** Activating this command will produce a tremendous amount of ongoing log data since the 8924C continually sends these messages. To deactivate this display, press the 'o' key again. An example of the output of this command follows:

```
Paging Overhead Message display Enabled.
MON: Raw Paging frame -
Paging message ID = 3, Number of bits = 152
13 03 06 01 80 48 16 81 80 19 81 B0 1C 81 E0 10 D4 E4 DE 0

MON: Raw Paging frame -
Paging message ID = 4, Number of bits = 72
09 04 06 00 60 10 93 40 2A 0

MON: Raw Paging frame -
Paging message ID = 1, Number of bits = 264
21 01 06 00 00 1C 00 04 1D 08 00 09 C0 9F 00 14 F3 59 99 17 9C 00 44 47
83 07 1C 81 4C 0B 64 A3 F0 0

MON: Raw Paging frame -
Paging message ID = 2, Number of bits = 152
13 02 06 00 00 00 4F 40 00 00 00 02 80 08 80 3A 7B 51 0B 0

MON: Raw Paging frame -
Paging message ID = 3, Number of bits = 152
13 03 06 01 80 48 16 81 80 19 81 B0 1C 81 E0 10 D4 E4 DE 0

MON: Raw Paging frame -
Paging message ID = 4, Number of bits = 72
09 04 06 00 60 10 93 40 2A 0
```

'p' The 'p' special command displays the current parameters being used on the Paging Channel. When the 'p' key is pressed, the logging PC displays:

```
Paging channel parameters:
  CS_PG_CHAN(400:0x190) = 1
  ____ IS-95 CDMA Channel List Message ____
  CDMA Frequency List - 1 frequencies defined.
  Channel 0 is 384
  ____ IS-95 Neighbor List Message ____
  CDMA Neighbor List - 7 neighbors defined.
  Pilot increment is 12
  Neighbor - Config = 0, PN offset = 36
  Neighbor - Config = 0, PN offset = 180
  Neighbor - Config = 0, PN offset = 192
  Neighbor - Config = 0, PN offset = 0204
  Neighbor - Config = 0, PN offset = 216
  Neighbor - Config = 0, PN offset = 228
  Neighbor - Config = 0, PN offset = 240
```

'q' The 'q' special command is for internal Agilent Technologies use only. It provides no useful information to the user about the performance of the CDMA mobile station.

's' The 's' special command displays the current parameters being used on the system overhead message. Pressing the 's' key displays information similar to the following:

```
System parameters:
CS_SID(200:0xC8) = 7
CS_NID(201:0xC9) = 1
CS_REG_ZONE(202:0xCA) = 116
CS_TOTAL_ZONES(203:0xCB) = 1
CS_ZONE_TIMER(204:0xCC) = 0
CS_BASE_ID(205:0xCD) = 39
CS_BASE_CLASS(206:0xCE) = 0
CS_PAGE_CHAN(207:0xCF) = 1
CS_MAX_SCYCLE_INDEX(208:0xD0) = 1
CS_REG_PRD(209:0xD1) = 0
CS_BASE_LAT(210:0xD2) = 686508
CS_BASE_LONG(211:0xD3) = -1686041
CS_REG_DIST(212:0xD4) = 0
CS_SRCH_WIN_A(213:0xD5) = 8
CS_SRCH_WIN_N(214:0xD6) = 8
CS_SRCH_WIN_R(215:0xD7) = 8
CS_NGHR_MAX_AGE(216:0xD8) = 15
CS_PWR_REP_THRESH(217:0xD9) = 0
CS_PWR_REP_FRAMES(218:0xDA) = 12
CS_PWR_REP_DELAY(219:0xDB) = 14
CS_T_ADD(220:0xDC) = 28
CS_T_DROP(221:0xDD) = 32
CS_T_COMP(222:0xDE) = 5
CS_T_TDROP(223:0xDF) = 3
CS_HOME_REG(224:0xE0) = 1
CS_FOR_SID_REG(225:0xE1) = 1
CS_PWR_UP_REG(227:0xE3) = 1
CS_PWR_DOWN_REG(228:0xE4) = 0
CS_PARAMETER_REG(229:0xE5) = 0
CS_PWR_THRESH_ENABLE(230:0xE6) = 0
CS_PWR_PERIOD_ENABLE(231:0xE7) = 0
CS_EXT_NGHR_LIST(232:0xE8) = 1
CS_EXT_SYS_PARAMETER(233:0xE9) = 1
CS_GLOBAL_REDIRECT(234:0xEA) = 0
```

't' The 't' special command displays the currently set system time. Pressing the 't' key will display information similar to the following:

```
System Time: Fri Jul 10, 1998 08:56:07 .99750 [0x33]
```

'u' The 'u' special command is for internal Agilent Technologies use only. It displays information about the internal operating system queue.

'v' The 'v' special command is for internal Agilent Technologies use only. It displays the internal firmware and CPU version information for the cell site board associated with the logging port the PC is connected to, similar to the message below.

```
CPU Version CD Step: D
System built on Jul 16, 1998 at 15:45:39
```



- 'w' The 'w' special command is for internal Agilent Technologies use only. It provides no useful information to the user about the performance of the CDMA mobile station.
- 'z' This command locks the serial input.
- '.' The '.' (period) special command toggles the display of internal status request messages. Activating this command causes no problems but will reduce the amount of nonessential logging data. This makes it easier to work with the logged data. Pressing the period key displays the following message.

Status Request Message display set to OFF.

- '?' Pressing the '?' key displays the help screen that details the available special commands. See page 11, Using the Control Modes on Logging Port 2.

## Traffic Channel Logging

All over-the-air messages that are sent and received by the 8924C through the traffic channel are available on logging Serial Port 1 (from the breakout adapter). The next section will review a number of more important messages that can be examined on Serial Port 1. This section is not a complete listing of all protocol messages supported by the 8924C.

## Forward Traffic Order Messages

The base station can send a number of different types of order commands through the traffic channel on the forward traffic channel. Some common types of forward order messages include acknowledgment orders, service option response orders, and release orders. Depending on how the protocol is implemented in the mobile, the base station may be required to provide an acknowledgment message to indicate that the mobile's message was received. In general, the 8924C will acknowledge any message it receives from a mobile. Shown below are an acknowledgment order and a release order:

```

_____ Forward Traffic Order Message _____
Timed      = 0x0
Time       = 0x0000000000000000
MsgType    = 0x1
AckSeq     = 0x0
MsgSeq     = 0x0
AckReq     = 0x0
Encryption = 0x0
UseTime    = 0x0
ActionTime = 0x3E
Order      = Base Station Acknowledgment Order (0x10)
AddRecordLen = 0x0

_____ Forward Traffic Order Message _____
Timed      = 0x0
Time       = 0x0000000000000000
MsgType    = 0x1
AckSeq     = 0x4
MsgSeq     = 0x4
AckReq     = 0x0
Encryption = 0x0
UseTime    = 0x0
ActionTime = 0x39
Order      = Release Order (0x15)
AddRecordLen = 0x0

```

## Mobile Station Acknowledgment Messages

Some base station messages require an acknowledgment from the mobile. In the 8924C, all handoff direction messages require mobile acknowledgment. When the 8924C receives acknowledgment, the 8924C proceeds with the handoff. When a mobile station acknowledge is received, it appears as follows in the logging data stream:

```
_____ Reverse Traffic Order Message _____  
Ack_seq = 0x0  
Msg_seq = 0x0  
Acknowledge is NOT required  
Order Message - Mobile Station Acknowledgment Order (0x10)  
ADD_RECORD_LEN = 0
```

## Base Station Handoff Direction Messages

Whenever the base station orders a handoff, it sends a handoff direction message to the mobile. Handoffs in the IS-95A system include:

1. CDMA hard handoffs to a new frequency,
2. hard handoffs to a new PN Offset,
3. hard handoffs to a new Walsh Code,
4. soft and softer handoffs, and
5. CDMA to analog hard handoffs.

When the 8924C is directed to perform a handoff, it sends the following types of message:

```
_____ Forward Traffic Handoff Direction Message _____  
Timed = 0x0  
Time = 0x0000000000000000  
MsgType = 0x5  
AckSeq = 0x0  
MsgSeq = 0x0  
AckReq = 0x1  
Encryption = 0x0  
USE_TIME = 0x1  
ACTION_TIME= 0x10  
HDM_SEQ = 0x0  
SRCH_WIN_A = 0x8  
T_ADD = 0x1C  
T_DROP = 0x20  
T_COMP = 0x5  
T_TDROP = 0x3  
FRAME_OFFSET = 0x0  
PRIVATE_LCM = 0x0  
RESET_L2 = 0x0  
ENCRYPT_MODE = 0x0  
FREQ_INCL = 0x1  
CDMA_FREQ = 0xD3  
There were 1 copies of the Pilot PN record.  
PILOT_PN = 0xC  
POWER_COMB_IND = 0x1  
CODE_CHAN = 0x8
```

## Mobile Station Handoff Complete Messages

When the mobile has completed the handoff and reacquired the base station signal, it sends a handoff complete message to the base station. When the 8924C receives a handoff complete message, it is logged on the traffic channel's serial port. The message is displayed as follows:

```
____ Reverse Traffic Handoff Complete Message ____
Ack_seq = 0x0
Msg_seq = 0x1
Acknowledge is required
LAST_HDM_SEQ = 0x0
PILOT_PN = 0xC
```

## Mobile Station DTMF Tone Messages

In order to support devices such as voice mail system that rely on the use of analog DTMF tones, the IS-95A system supports signaling messages that indicate to the base station that the user has pressed a DTMF during a phone call. When the user presses a number on the mobile's keypad during a call, the mobile sends a message to the 8924C. The 8924C logs these messages as follows:

```
____ Reverse Traffic Send Burst DTMF Message ____
Ack_seq = 0x7
Msg_seq = 0x1
Acknowledge is required
DTMF on length = 350 mSec
DTMF off length = 150 mSec
1 digits received - 1
OR
____ Reverse Traffic Send Burst DTMF Message ____
Ack_seq = 0x7
Msg_seq = 0x2
Acknowledge is required
DTMF on length = 350 mSec
DTMF off length = 150 mSec
1 digits received - 2
```

This feature allows the debugging or verification that the mobile station will work properly with those devices requiring DTMF support.

## Mobile Station Reporting Messages

While on a traffic channel, a mobile station may send a number of different signaling messages to the base station. Two of the most common messages are the Reverse Traffic Pilot Strength Message and the Reverse Traffic Power Measurement Message. The mobile sends the pilot strength message whenever it detects that a pilot channel meets threshold criteria. The reverse power measurement message is activated by the base station and reports the number of frame errors that the mobile has detected. These messages are logged by the 8924C on the traffic channel and appear as follows on the PC's display:

```
_____ Reverse Traffic Pilot Strength Message _____  
Ack_seq = 0x0  
Msg_seq = 0x2  
Acknowledge is required  
REF_PN = 0xC  
PILOT_STRENGTH = 0x10  
KEEP = 0x1  
PILOT_PN_PHASE = 0x900  
PILOT_STRENGTH = 0x1C  
KEEP = 0x1  
  
OR  
  
_____ Reverse Traffic Power Measurement Message _____  
Ack_seq = 0x2  
Msg_seq = 0x3  
Acknowledge is NOT required  
ERRORS_DETECTED = 0x0  
PWR_MEAS_FRAMES = 0x28  
LAST_HDM_SEQ = 0x2  
NUM_PILOTS = 0x1  
PILOT_STRENGTH = 0x11
```

## Using the Control Modes on Logging Port 1

A number of very useful control modes are also available for special applications on logging Port 1. Like the commands available on Port 2, typing single characters on the PC's keyboard (once the logging connection has been activated) activates these modes. To view a menu of the available commands, simply type the ? character (Shift key, then the / key). For clarity, make sure that a CDMA call is not active when you request the control menu. When the ? is typed while logging on Port 1, the PC displays the following:

All commands are a single character. A carriage return is not required. Any characters not interpreted as a command will be echoed. Case is ignored.

- a - Displays the (A)ccess Channel parameters.
- b - Information on (B)uffer pools used in the system.
- c - Displays CDMA (C)hannel parameters.
- d - Toggles fast (D)isplay of Tx and Rx traffic frames (in hex).
- e - Displays Pow(er) control bit totals - zeroes those totals.
- f - Starts the (F)lash programming subsystem.
- i - Displays the Wr(i)te only CSM register values .
- l - Toggles Open/C(l)osed loop power control before connection.
- m - Displays the (M)onitored parameters for Encoder, Decoder.
- o - Toggles log of (O)verhead messages on the Sync Channel.
- p - Toggles the (P)ower control bit display.
- q - Displays the (Q)uery CellSite Status value.
- r - Toggles the (R)everse Traffic Power Statistics display.
- s - Displays the (S)ync Channel parameters.
- t - Displays the (T)raffic Channel parameters.
- u - Displays the Q(U)ueue information.
- v - Firmware & CPU (V)ersion information.
- w - Displays the (W)rite Program RAM Status Flag.
- y - Displays the S(y)stem overhead message parameters.
- z - Locks the Serial input.
- + - Increments Active Power Control threshold.
- - Decrements Active Power Control threshold.
- , - (Comma) Toggles display of Tx/Rx Frame Rate Character.
- . - (Period) Toggles display of Status Request Messages.
- ? - Gives this help screen.
- / - SMS and Display Control Help Screen.

When traffic is active, the following characters are displayed:

Rate of frame transmitted to mobile:

8K: '1'=full, '2'=half, '3'=quarter, '4'=eighth, '0'=corrupt

13K: '5'=full, '6'=half, '7'=quarter, '8'=eighth

Rate of frame received from mobile:

8K: 'F'=full, '-'=half, '\_'=quarter, '.'=eighth, ' '=corrupt, and  
'f'=full rate likely

13K: 'S' =full, '|' =half, '^' =quarter, ':' =eighth, and  
's' =full rate likely

13K: 'S'=full, '|'=half, '^'=quarter, ':'=eighth, and  
's'=full rate likely

## Control Mode Command Descriptions

A brief description of each control mode command follows:

'a' Pressing the 'a' causes the 8924C to display the active parameters for the access channel. The logging PC will display an image similar to this screen:

```
Access channel parameters:
  CS_ACC_CHAN(300:0x12C) = 0
  CS_NOM_PWR(301:0x12D) = 0
  CS_INIT_PWR(302:0x12E) = 0
  CS_PWR_STEP(303:0x12F) = 3
  CS_NUM_STEP(304:0x130) = 5
  CS_MAX_CAP_SZ(305:0x131) = 7
  CS_PAM_SZ(306:0x132) = 10
  CS_PSIST0_9(307:0x133) = 0
  CS_PSIST10(308:0x134) = 0
  CS_PSIST11(309:0x135) = 0
  CS_PSIST12(310:0x136) = 0
  CS_PSIST13(311:0x137) = 0
  CS_PSIST14(312:0x138) = 0
  CS_PSIST15(313:0x139) = 0
  CS_MSG_PSIST(314:0x13A) = 0
  CS_REG_PSIST(315:0x13B) = 0
  CS_PROBE_PN_RAN(316:0x13C) = 0
  CS_ACC_TMO(317:0x13D) = 5
  CS_PROBE_BKOFF(318:0x13E) = 0
  CS_BKOFF(319:0x13F) = 0
```

'b' The 'b' special command is for internal Agilent Technologies use only. It provides no useful information to the user about the performance of the CDMA mobile station.

'c' Pressing the 'c' key causes the 8924C to display the current parameters for all of the CDMA channels. The logging PC will display an image similar to this screen:

```
CDMA Channel Parameters:
  Cellsite Protocol           = IS-95A
  Rate                       = 8K
  PN Offset of Sector A     = 12,   Sector B = 36
  Walsh Code of Pilot A     = 0,   Sync A = 32
  Traffic A                 = 8,   Traffic B = 0.
  Status of Pilot A        = ON,   Sync A = ON,
  Traffic A                 = OFF,  Traffic B = OFF.
```



'e' This command displays the power control bit totals (up bits and down bits) and then sets the total of each to zero. The following example shows what is displayed when 'e' is entered 4 times, with the wait between each entry getting shorter each time.

```
Up bits = 60371, Down bits = 60020
Up bits = 9115, Down bits = 9115
Up bits = 1921, Down bits = 1921
Up bits = 78, Down bits = 80
```

- 'f' This command is for internal Agilent Technologies use only. CAUTION: Misuse of this command can result in the destruction of the 8924C firmware causing the unit to not operate. This command should only be used if you are directed to do so by an Agilent Technologies service center.
- 'i' Displays the write-only parameters currently set into the CSM™ chips on the Digital Cellsite 1 board. The 'i' special command is for internal Agilent Technologies' use only. It provides no useful information to the user about the performance of the CDMA mobile station. Issuing this command does not alter the state of the instrument and therefore cannot cause problems.
- 'l' Evoking the 'l' special command toggles the type of power control used by the 8924C during call processing. The default mode for the 8924C is the "Open Loop" mode. Switching to the "Closed Loop" mode may have undesirable effect. CAUTION: Use this special command at your own risk.
- 'm' The 'm' special command is for internal Agilent Technologies use only. It provides no useful information to the user about the performance of the CDMA mobile station.
- 'o' The 'o' special command toggles the logging of the sync channel message. When active (the default is inactive), this command causes every sync channel overhead message to be logged. The sync message data is logged in hex format.

**IMPORTANT:** Activating this command will produce a tremendous amount of ongoing log data since the 8924C continually sends the sync message. To deactivate this display, press the 'o' key again. An example of the output of this command follows.

```
Sync frame retrieval Enabled.
MON: Sync channel frame.
19 01 01 01 00 0E 00 02 0C 3C D6 FF 30 B2 C6 54 44 4A E4 00 0A 08 BD 6A
D1 00 00 00 00 00 00 00 00 00 00 00 0

MON: Sync channel frame.
19 01 01 01 00 0E 00 02 0C C3 26 B3 47 E1 86 54 44 4A F0 00 0A 31 D1 A2
4F 00 00 00 00 00 00 00 00 00 00 00 0

MON: Sync channel frame.
19 01 01 01 00 0E 00 02 0C 2C C5 04 64 74 46 54 44 4A FC 00 0A 08 49 61
26 00 00 00 00 00 00 00 00 00 00 00 0

MON: Sync channel frame.
19 01 01 01 00 0E 00 02 0C BA 1F 88 4E D7 46 54 44 4B 08 00 0A 2B 48 AB
DB 00 00 00 00 00 00 00 00 00 00 00 0
```







- '.' The '.' special command toggles the display of internal Status Request Messages. Activating this command causes no problems but will reduce the amount of nonessential logging data. This makes it easier to work with the logged data.
- '?' Typing a '?' displays the help screen that details the available special commands, see page 21, Using the Control Modes on Logging Port 1.

## SMS Logging

If the phone is in idle mode and logged onto the 8924C Test Set's forward paging channel, and the user commands the test set to send a SMS message, the Test Set sends the message to the phone using the address information in the MS database with a data burst message on the paging channel. To perform SMS logging, the phone should be in idle mode and logged onto the 8924C test set's forwarding paging channel. The user commands the test set to send a SMS message and the test set sends the message to the phone using the address information in the MS database with a data burst message. If the phone successfully receives the message, it sends a SMS received acknowledge to the test set using a data burst message on the access channel.

If a call is in progress, the same messaging will be sent on the traffic channel, instead of the paging and access channels.

It is important to note that if you are connected to Port 1, you can only see traffic channel messages. You will not be able to see SMS messages sent to a phone in idle state. Conversely, if you are connected to Port 2, you can only see paging channel messages. You will not be able to see SMS messages sent to a phone in a call.

### SMS and Display Control Help Screen

```
-----
Commands are a single character.
Commands which determine the category of information that
will be displayed:
! - Display All Messages
@ - Display Only SMS Messages.
# - Display Only Critical Messages.
Commands enabled when "Display Only SMS Messages" is selected.
These determine where SMS messages will be displayed:
$ - Do not display SMS Messages.
% - Display SMS Traffic Msgs on Board 1, Page/Access Msgs on Board 2
^ - Display All SMS Messages on this Port.
& - Display All SMS Messages on the other Port.
? - Gives the general help screen.
/ - Gives this Special SMS help screen
```

When the '/' is pressed while logging, the 8924C displays the following screen on the PC:

The following section describes each of these commands and gives example results of using them:

- '!' Typing the '!' command sets the screen to display commands from the paging or traffic channel. SMS commands are also shown, but are not easily distinguishable from other messages.
- '@' Typing the '@' command sets the screen to display only SMS messages by enabling the \$, %, ^, and & commands.
- '#' Typing the '#' command sets the screen to display nothing.

These determine where SMS messages will be displayed.

'\$' Typing the '\$' command sets the screen not to display SMS messages.

'%' Typing the '%' command does the following:

If the serial cable is hooked up to Port 1, then messages on the traffic channel will be displayed when an SMS message is sent during a call. Nothing will be displayed when the phone is idle.

```
=====
Forward Traffic Channel SMS Data Burst Message:
  NUM_MSGS:      1,      SMS Message Type: SMS Point-to-Point
  -----
  Teleservice Identifier          0x10 0x02
  -----
  Originating Address:           0x01 0xe4 0x85 0x2a 0x84
  -----
  Bearer Reply Option:           0x1c
  -----
  Bearer Data Message:
  #####
  Message Identifier              0x10 0x00 0x00
  -----
  User Data
    MSG_ENCODING = 02  NUM_FIELDS = 02
    0x91 0x24
  #####
  =====
Reverse Traffic Channel SMS Data Burst Message:
  NUM_MSGS:      1,      SMS Message Type: SMS Acknowledge
  -----
  Destination Address:           0x01 0xe4 0x85 0x2a 0x84
  -----
  Cause Codes                     0x1c
  =====
```

If the serial cable is connected to Port 2, then messages on the paging channel will be displayed when an SMS message is sent in the idle state. Nothing will be displayed during a call.

```

=====
Paging Channel SMS Data Burst Message:
NUM_MSGS:      1,      SMS Message Type: SMS Point-to-Point
-----
Teleservice Identifier          0x10 0x02
-----
Originating Address:           0x01 0xe4 0x85 0x2a 0x84
-----
Bearer Reply Option:           0x1c
-----
Bearer Data Message:

#####
Message Identifier              0x10 0x00 0x00
-----
User Data
MSG_ENCODING = 02  NUM_FIELDS = 02
0x91 0x24

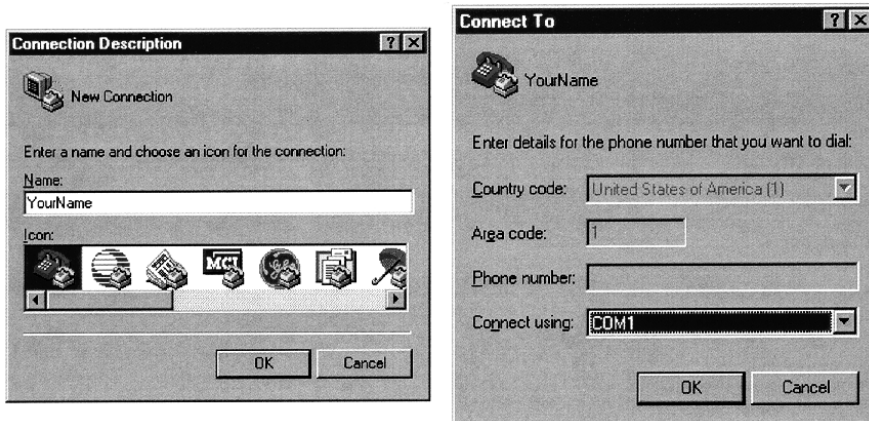
#####
=====
Access Channel SMS Data Burst Message:
NUM_MSGS:      1,      SMS Message Type: SMS Acknowledge
-----
Destination Address:           0x01 0xe4 0x85 0x2a 0x84
-----
Cause Codes                     0x1c
=====

```

- '&' Typing the '&' command sets the screen to display all SMS messages on the other port. Port 1 is the Traffic Channel, while Port 2 is the Paging Channel. For example, if the serial cable is connected to Port 1 (Traffic), pressing '^' will set the screen to display messages on Port 2. However, the serial cable must also be switched. Switching to the other port may confuse the user. WARNING: Use this special command at your own risk.
- '^' Typing the '^' command sets the screen to display all SMS messages back on your original port. It cancels the effect of the '&' command.
- '/' Typing the '/' key displays the SMS help screen that details the available SMS commands.

## Appendix A: Windows 95/NT HyperTerminal Setup

1. Open HyperTerminal from the Accessories group.
2. Select the HyperTerminal icon (Hypertrm.exe).
3. In the Connection Description menu, enter a name and choose an icon for this connection (such as “8924C Protocol Logging”) and click OK.



4. On the Connect To menu, change the Connect using: field from whatever modem is listed to Direct To Com 1 (or Com 1 for Windows NT) and click OK.

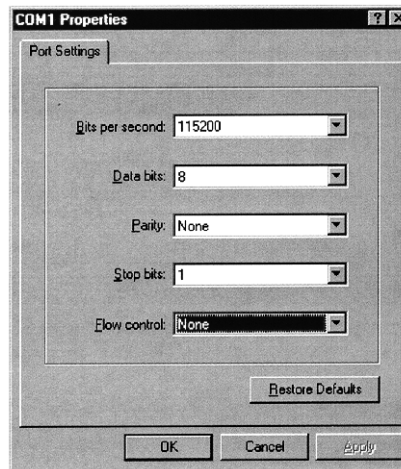
5. On the COM 1 Properties menu, under Port Settings, set as follows.

- Bits per second: 115200
- Data Bits: 8
- Parity: None
- Stop Bits: 1
- Flow Control: None

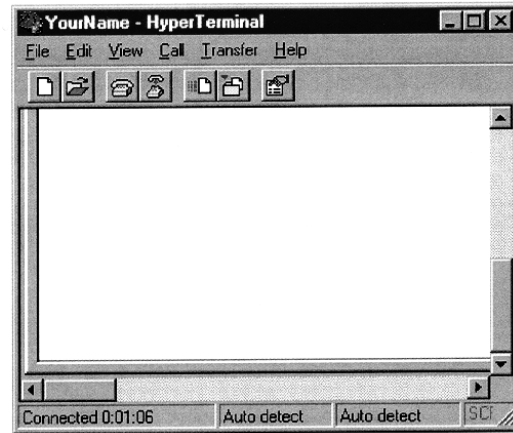
6. Skip steps 6 and 7 if you are using Windows NT. Otherwise, select the Advanced command button on the COM1 Properties menu. Set the following:

- a. Check the Use FIFO buffers box.
- b. Set the Receive Buffer arrow to High (14).
- c. The Transmit Buffer arrow can be left at Low (1).
- d. Click OK on the Advance Port Settings box.

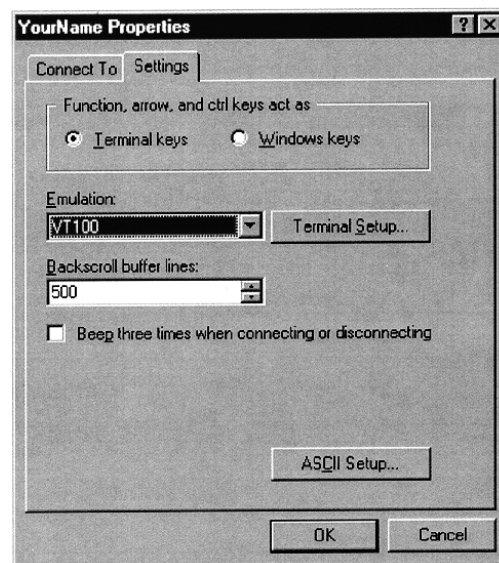
7. Click OK on the Com 1 Properties box.



8. You will see a blank window area with a top title bar showing the file name you chose and “HyperTerminal”. On the top menu bar of the “YourName”-HyperTerminal window, select File, then Properties.

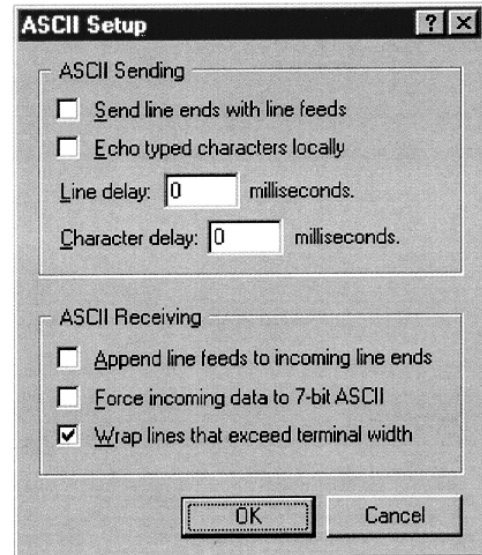


9. In the “YourName” Properties box, select the Settings tab.
  - a. In the Settings box: under Emulation, choose VT100.



- b. Now choose the ASCII Setup button (bottom of Settings box).

- c. Make sure the box is checked for Wrap lines that exceed terminal width and click OK. If you are using Window NT, you may need to repeat this step, after you start receiving a log file.



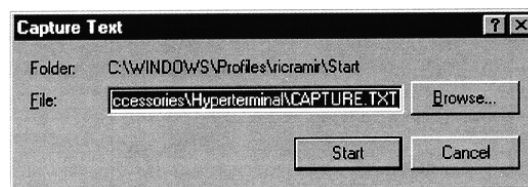
10. On the “YourName” Properties box, click OK

11. Now you are ready to receive a log file.

- a. On the top menu bar, select Call, then Connect. This may not be necessary for Windows NT.
- b. Connect the serial cable to the PC serial port first, then to one of the 8924C logging connectors.

CAUTION: Never leave the serial cable attached to the 8924C if it is not attached to the PC. At these high data speeds, an unterminated cable sometimes causes signals to reflect back into the 8924C protocol system, which causes the instrument to FREEZE UP. Only a power-cycle will correct this.

- c. Now select Transfer, then Capture Text. The Capture Text file name-entry box will pop up. Enter the name of the file you want the captured protocol log stored under, then click Start.



- d. Now perform the call processing tests you want to log on the 8924C. You should see data scroll by on the display.
12. When finished, select Call, then Disconnect. Now select Transfer, Capture Text, and Stop to end the data capture.
13. Then exit HyperTerminal. (The first time you exit you will be asked if you wish to save this session. To save the settings you have made in this setup procedure, choose the “Yes” command box.)
14. You can read the captured file with any text editor (such as Notepad).





Now the MODEM OPTIONS should be highlighted with inverse video. Using the PC's arrow keys move the highlight bar down to the TERMINAL OPTIONS selection. Press the ENTER key on the PC. The PC should now display the this screen:

```

-----
PROCOMM PLUS SETUP UTILITY                                TERMINAL OPTIONS
-----
A- Terminal emulation ..... VT100      K- EGA/VGA true underline ... OFF
B- Duplex ..... FULL                    L- Terminal width ..... 80
C- Soft flow ctrl (XON/XOFF) .. OFF     M- ANSI 7 or 8 bit commands . 7 BIT
D- Hard flow ctrl (RTS/CTS) .. OFF
E- Line wrap ..... ON
F- Screen scroll ..... ON
G- CR translation ..... CR
H- BS translation ..... DESTRUCTIVE
I- Break length (milliseconds) .. 350
J- Enquiry (ENQ) ..... OFF
-----
Alt-Z: Help ;      Press the letter of the option to change:      ; Esc: Exit
-----

```

You need to modify the settings to match those shown above. To access each option, press the corresponding letter in front of each selection. The two most critical settings on this screen are: Terminal emulation = VT100, and Duplex = FULL. Once you have all of the parameters on this screen set to match the display above, exit this screen by pressing the 'ESC' key.

You now must select the HOST MODE OPTIONS from the SETUP UTILITY screen. Scroll down from the TERMINAL OPTIONS using the arrow keys so that the highlight bar is on the HOST MODE OPTIONS selection. Press the ENTER key. The PC should look like this:

```

-----
PROCOMM PLUS SETUP UTILITY                                HOST MODE OPTIONS
-----
A- Welcome message ... Welcome to PROCOMM PLUS Host!
B- System type ..... OPEN
C- Auto baud detect .. ON
D- Connection type ... DIRECT
E- Host timeout ..... 5 (minutes)
F- Goodbye action ... RECYCLE
G- New user level ... 1
H- Upload directory .
I- Download directory
J- Use SHLLBOOT .... NO
-----
Alt-Z: Help ;      Press the letter of the option to change:      ; Esc: Exit
-----

```

This screen allows you to specify a welcome message and the behavior of the host. The parameter that you must set on this screen is the Connection type. To do this, press the D key. The cursor will now flash under the current setting for the Connection type field. Using the space bar on the keyboard, cycle the selection until it displays DIRECT. Return to the SETUP UTILITY MAIN MENU by pressing the ESC key. You now must save the changes you have made. To save the changes, scroll down to the selection labeled SAVE SETUP OPTIONS. Once the highlight bar is on the SAVE SETUP OPTIONS, press the ENTER key. Return to the normal mode of operation by pressing the ESC key.

The last setup task is to configure the serial port on the PC to communicate with the 8924C's serial ports. To configure the serial port, press the ALT key and the P key at the same time. The PC will display this screen:

```

PROCOMM PLUS Ready!
-----
CURRENT SETTINGS: 115200,N,8,1,COM1
-----
BAUD RATE  PARITY  DATA BITS  STOP BITS  PORT
1) 300      N) NONE    Alt-7) 7    Alt-1) 1    F1) COM1
2) 1200     E) EVEN    Alt-8) 8    Alt-2) 2    F2) COM2
3) 2400     O) ODD     Alt-9) 9    Alt-3) 3    F3) COM3
4) 4800     H) HALEX   Alt-0) 0    Alt-4) 4    F4) COM4
5) 9600     S) SPACE   Alt-1) 1    Alt-5) 5    F5) COM5
6) 19200    Alt-N) N/8/1
7) 38400    Alt-E) E/7/1
8) 57600    Alt-N) N/8/1
9) 115200   Alt-E) E/7/1
Esc) Exit  Alt-S) Save and Exit  YOUR CHOICE:
-----

```

The current port settings are displayed on the upper line of the display. In this example the current settings are:

- baud rate = 115200
- parity = none
- data bits = 8
- stop bits = 1
- port = com1

These are the correct data format and data rate settings for CDMA protocol logging. Use the corresponding key in front of each setting to set the values indicated above. The only setting that will be specific to your setup will be the port. Select the PC's serial COM port that you have connected to the 8924C. When the current settings are correct, press the ALT key and the S at the same time. This will save the port configuration and return you to the main screen.

## Capturing a Log Using PROCOMM PLUS

Now that you have verified the setup, you are ready to perform protocol logging. In its normal mode of operation, all commands and messages that are sent and received by the 8924C will be displayed on the PC. To capture a permanent log that can be evaluated at a later date, you need to active the log capture mode in PROCOMM PLUS. To begin capture of logging data, press the ALT key and the 'F1' key at the same time. The PC will then display a pop-up box that requests a name for the file in which to store the log:

```

PROCOMM PLUS Ready!
-----
Enter log filename (CR for default):
-----

```

At this point, type in a name for the log file such as log.txt. When you are finished logging, close the log file by pressing the ALT key and the F1 key at the same time. The status bar at the bottom of the PC's display will indicate that the log has been closed. To examine the log file, exit PROCOMM PLUS by pressing the ALT key and the x key at the same time. When PROCOMM PLUS asks if you want to exit to DOS, press the y key. Once you have exited PROCOMM PLUS, you can use any text editor to examine the log file. The editor that is included with MS-DOS works well for this purpose. From the prompt, activate the editor by typing in EDIT followed by the location and filename of the log file. For the example above, you would type EDIT C:\PCPLUS\LOG.TXT.

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