FAX and DATA modems with voice Mail

COLLABORATORS

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FAX and DATA modems with voice Mail

1.1   FAX and DATA modems with voice Mail

```
VoDaFax


EXTENDED AT COMMANDS


FAX & DATA MODEMS
WITH VOICE MAIL AND BUSINESS AUDIO CAPABILITY
```

```
REV 2.31 December  1993
```

Note that this is the final document describing the command set supported by the 3.15(a–z) series firmware. The final firmware in this series is 3.15V1 1.

This document is for use by developers of application software to support Sierra Voice and fax modems. It represents the production released commands implemented as of December 1993 and is intended for use with our ST 4743 chipset which supports Class 2 9600 fax , 2400 data , MNP and V.42bis as well as voice. Caller ID and Business Audio are also supported.

Sierra's command set has been field proven and is used in production VoDaFax devices. Sierra modems that support this command set will include the string "voice 2.3" in the response to ATI4.

Revised December 1993

PURPOSE OF DOCUMENT

This document specifies Sierras VoDaFax product firmware and software interface for addition of voice processing functions to Sierras Fax and Data chip set ST4743.

REFERENCE DOCUMENTS

530001 2400bps modem commands & S-register guide.
530002 EIA 2388 class 2 command summary.

FUNCTIONAL REQUIREMENTS

The VoDaFax product offers the features outlined in the following sections.
 These include the ability to send and receive Voice and DTMF signals from
 the telephone line, to record and play back voice messages through the
 local telephone set, and to identify incoming calls as voice, fax or data.

SIERRA DEMO HARDWARE

A PC compatible, tested circuit card will be provided by Sierra for software
 developers. This PC card uses the ST4743 chip set and includes a hardware
 RAM buffer of at least 32Kx8. Demos include facility for local telephone
 power and so the 'phone may be used for record and playback. Provision
 for Caller ID is also built in and is supported by the firmware.

Serial demo boards are also available in very limited number for
 developers. These are configured to include caller ID and voice relays for
 local record and playback using the local telephone. Headset support and
 ability to detect local phone off hook and line reversal are also available
 .

PC INTERFACE

The product communicates with the host (PC) through the parallel PC bus or
 serial COM port, or through DMA. Products with DMA interfaces will also be
 capable of communicating through a COM port. This will allow the use of
 existing fax and data software. DMA is only required for voice transmit
 and record modes.   The serial interface operates using a maximum serial
 rate of 115Kbit/s. With 2:1 compression and 4800 s/s the data rate is a
 maximum of 24000 bps. including start and stop bit overhead. With our
 CVSD compression the data rate is only 18250 bps. including start and stop
 bit overhead. This allows a Microsoft Windows COM driver interface to
 operate at a data rate of 19200 bps, (This is the maximum data rate
 guaranteed to work with a 16C450 UART and Windows by Microsoft). DMA
 interfaces allow the higher sampling rates of 9600 samples / second and
 11025 samples / second to be used without compression, in the background,
 from DOS or Windows. DOS foreground only applications can use 4800 s/s w
ithout compression, setting the data rate to at least 57600 bps or 9600 s/s
 without compression, setting the data rate to 115200 bps.

The COM port interface is used with a software FIFO option to reduce
 interrupt overhead. In the serial mode, the CTS signal will be used to
 control data flow from host (DTE) to DCE. Optionally <XON><XOFF> may be
 used (with caution). ACK will be used to coordinate data transmission
 from DCE to DTE.. See flow control section for further discussion on this
area.

DMA INTERFACE

All boards contain serial COM port interfaces, be they stand alone RS 232D
 or internal parallel cards. Additionally, higher-end boards will contain
 DMA interfaces for handling the high data bandwidth requirements of
 uncompressed voice.

To use the DMA interface from within voice mode, the application must
 specify a DMA block size with the #VBSn command and a DMA channel with the
 #VCH=n command. The voice stream initiated by a voice record or play
 command will then be redirected by the DCE to the internal or host UART

scratch pad register. DCE hardware will ensure that DMA acknowledges from
 the DTE will be decoded to the scratch pad register.

See Appendix E, DMA Handshaking, for more information.

ON-BOARD BUFFERING

RAM will be used for buffering of the voice data when in the transmit or
 receive mode . Normally the product will be used with 8-32K x8 RAM on the
 card which is also used for data compression and error correction. The
 voice buffer is set to 16K, allowing for 1.5 seconds of buffered voice to
 be held on the DCE, at 11K s/s.

EXTENDED AT COMMANDS SUMMARY

The product will respond to the following extended AT commands and will
 configure the chip set accordingly. Each command consists of an ASCII
 string started by AT and terminated by a carriage return and line feed (<CR
>,<LF>).

In voice transmit modes as in fax modes, the DTE shall signal the DCE to
 enter command mode by dropping DTR. The DCE will respond to DTR
 according to the AT&Dn instruction.

Command mode may be entered from voice receive mode by the DLE sequence
 <DLE> <ETX> as detailed in appendix B, or by dropping DTR. The DCE will
 respond to DTR according to the AT&Dn instruction.


```
    AT# Cmd              Action

        VSn              Activate voice mode (DTE rate n)
        VSV              Transmit voice data, listen for DTMF
        VD0              Transmit voice data
        VD1              Receive voice data
        VT1              DTMF receive enable
        VT0              DTMF receive disable
        VSI=?n            Sets silence end of message timer. (100ms)
        VSS=R            Set sample rate to R
        VQS              Request available sample rates
        VQS?             Request current sample rate
        VSM=C            Set CODEC mode to C
        VQM              Request CODEC modes
        VQM?             Request current CODEC mode
        VSC=X            Set compression mode to X
        VQC              Request compression mode available
        VQC?             Request current compression mode
        VH=X             Activate relay X
        VST=0/1 Set silence threshold -43dBm/-47dBm
        VC=0,1           Disable, Enable <DLE><CAN>
        VB=f1,t          Send tone beep of frequency f1  (x10 Hz)
                         and duration t (x100ms)
        VF=n             Set FIFO size ( default =64)
        VRA=n            Ringback goes away timer (100ms)
        VRN=n            Ringback never came timer (100ms)
        VG=xxx   Gain setting in voice receiver - default = 119
```

```
        VSD=0,1,2        Silence deletion control (disable, 1sec, 0.5sec)
        VL=n             Set run-length encoding
        VAA=n            Select Auto answer modes
        VAA?             Query auto answer modes
        VBS=n            Specify data transfer via DMA (n=block transfer size).
        VQB              Request list of available DMA block transfer sizes.
        VQB?             Request current setting for DMA block transfer size.
        VCH=n            Set DMA channel.
        VBO=M    Set binary offset mode.
        VQO?             Query binary offset mode.
        VM=M             Microphone command.
        VSP=P            Snoop command.
        VQP?             Query snoop mode.
        VNH=n    Set hook behavior for fax and data calls within voice calls.
        VQH?             Query hook behavior for fax and data calls within voice  ↩
           calls.
        VZ=M             Set audio mode.
        VQZ?             Query audio mode.
```

RESPONSE CODE SUMMARY

The product will return brief responses to all AT commands. Each response
 will consist of an ASCII string and will be preceeded by, and terminated by
 a carriage return and line feed (<CR>,<LF>). There are no terse responses
 in voice mode. The following are the responses that may be returned by the
 product.

```
        Response                            Reason

        CONNECT         Entered Voice TX or RX mode
        OK                   Command accepted and initiated
        ERROR                Error condition, illegal command
        #VQS:(S1-Sx)         Available sample rates
        #VQS=S          Current selected sample rate
        #VQM:(C1-Cx)         Available CODEC modes
        #VQM=?C          Current selected CODEC mode
        #VQC:(M1-Mx)         Available compression methods
        #VQC=?X          Current selected compression method
        #VH=?X                Current selected relay(s)0
        #VDn                 DTMF digit received
        #VTO                 Telephone went off hook
        #VTH                 Telephone went on-hook
        #VCON           Connect modem in voice mode.
        #VQB:(X1,X2,...Xn)     Available DMA block transfer sizes
        #VQO=?O          Current selected binary mode
        #VQP=?P          Current snoop mode
        #VQZ=?M          Current audio mode
        #VC=?n                Current cancel control - DTMF abort control mode
        #VDG                 Fax detected when #VAA=?129 or 130
        #VDD                 Fax detected when #VAA=?4
```

AT COMMANDS/RESPONSES SYNTAX

The following section details the proposed AT commands and the responses
 returned after a command is executed. All AT commands should be followed
 by carriage return and line feed. All responses will be followed by a
 carriage return and line feed.

If "ERROR" is received as a response to a command or a command string, you
 must rexecute that command or command string to ensure that the modem will
 behave as expected.

Voice commands will begin with AT#V. (AT+ is reserved for EIA standards use)

Commands are divided into two groups, CORE commands and CORE+ commands.
 CORE commands are VoDaFax commands which have been supported since the
 advent of 2.01 V.22bis firmware. CORE+ commands include the more advanced
 voice features such as DMA, and microphone commands which were developed
 under the 3.15(a-z) program. WaveFax modems use the CORE+ command set in
 addition to the CORE set.

CORE COMMANDS
CORE commands are available on V.22bis modems with 2.01 firmware, or above.
CORE commands are available on V.32bis modems with 1.00 firmware, or above.

VOICE MODE ACTIVATION

        This command is used to put the DCE in the voice mode. Upon entering
 this mode, the sampling rate is set to 9600s/s (or the rate last set by
 AT#VSS=? <rate> command) and the Mu Law compression algorithm is set. The
 DTE should delay at least 250 miliseconds after #VSS, before executing
 another command.

Syntax: #VSn
        n   DTE Rate
        0   Return to data mode
        1   115.2bit/s
        2   57.6kbit/s
        3   38.4kbit/s
        4   19.2 kbit/s

Response: OK   (Returned at the old rate)

RECEIVE VOICE DATA

        This command initiates voice data sampling and receiving. The
 sampled data will be moved to a holding buffer. If an external RAM buffer
 is present it will be used, otherwise 100bytes of internal RAM will be
 used. In parallel configuration, the controller will start feeding
 received bytes into the UART RXD register.

Syntax: #VD1
Response: CONNECT
                         data received <DLE><ETX>

TRANSMIT VOICE DATA & RECEIVE DTMF

        This command initiates voice data sampling and transmission to the
 D-A. The data is sampled at the set sample rate. DTR will be high for the
 data to be transmitted. The DTE data will pass through a buffer in the DCE

to await transmission. If an external RAM buffer is present it will be
used, otherwise the internal RAM will be used.   DTR low indicates end of
data. The DCE will transmit all remaining buffered data when DTR drops low
or <DLE><ETX> is received, and then goes to command mode.


```
Syntax:          #VSV
Response:               OK
                        CONNECT
                         transmission
                        OK
```


TRANSMIT VOICE DATA (Do not report DTMF)

This command is the same as VSV except no DTMF detection will be performed.

```
Syntax:          #VD0
Response:               OK
                        CONNECT
                        transmission
                        OK
```


FIFO COMMAND

```
Syntax:          AT#VF?  Returns maximum FIFO size in bytes.
Response:        X
        Where X is a decimal number indicating the size of the FIFO in bytes
.
```

```
Syntax:          AT#VF=?n Sets receive FIFO block transfer  size  to  n
                 bytes (32,64,128,256)
Response:        OK
```

```
Syntax:          AT#VF=?0 Disables FIFO
Response:        OK
```
The default flow control after "ATZ" is VF=?1 i.e. FIFO block transfer size
 =? 64 bytes.
See appendix A for a description of how to use the FIFO command with flow
control.

RECEIVE GAIN SETTING

```
Syntax:          #VG=?x
Response:        OK
```

The gain can be set in the range -6.2dB to 20.8dB in 256 steps. This
 command will set the initial gain level. Default value is 119 (6.4dB).

This command should be used with caution on DSP codes prior to CBD. The
 following information desribes the limitations of #VG under various modes.

Mu-Law and CVSD modes
Codes prior to CBD only support DTMF detection under Mu-Law or CVSD with the
 receive gain setting set to 60 or below. Receive gain settings of 61 or
 above may not reliably detect DTMF.

Linear mode
Codes prior to CBD divide the receive gain setting into 4 possible gains,
 0-63, 64-127, 128-191, and 192-256. DTMF will be detected using any gain
 from 0 to 256, however the actual gain will vary as follows:

```
        Setting          Gain

        0-63             0dB
        64-127           6dB
        128-191          9dB
        192-256          12dB
```

RUN LENGTH ENCODING

```
Syntax:          #VL=?0,1
Response:        OK
```

Run length encoding , if enabled, will compress equal valued samples
 (typically silence) and encode the data as follows: <DLE><L><Char>##H.
 Where ## is the byte count in Hex.

SILENCE DELETION CONTROL

This command is available in UART mode only, i.e. when #VBS=?0.

```
Syntax:          #VSD=?0,1,2
Response:        OK
```

```
0       Disabled
1       One second of silence is not compressed.
2       One half second of silence is not compressed.
```

This command is not recomended for use. It encodes silence periods with one
 <DLE><S> for every 256 consecutive bytes of silence. The codes are
 re-expanded on playback. Thus this command as actually implemented as a
 silence encoder, useful for conserving disk space, but not for truncating
 long periods of silence.

END OF MESSAGE TIMER

```
Syntax:          #VSI=?n
Response:        OK
```

End of voice message will be detected by silence for a period of time set
 in a register set by AT#VSI=?n   (100ms). At this time, the DCE will
 drop DCD and send <DLE><ETX> and go into command mode.

DTMF RECEIVE ENABLE (In command mode)

This command enables the reception of DTMF tones when the modem is in
 command state.
(See VSV command for DTMF detection during voice transmission.)

Syntax: #VT1
Response: OK

DTMF RECEIVE DISABLE

This command disables the reception of DTMF tone during voice data
transmission.

Syntax: #VT0
Response: OK

*** [This is the default condition in voice mode]

SAMPLE RATE SETUP

This command sets the sample rate. 8000Hz is the default value upon entering
 the voice mode.

Syntax: #VSS=?R
Response: OK
       where R =?   0   4800
                         1   7300   ....(SC11094 + CBB OR BETTER DSP CODE)
                         2   8000   ....(SC11092,4 ONLY) ***[default]
                         3   9600
                         4   11000   ....(SC11094 + ABH OR BETTER DSP CODE)
                         5   22000   ....[Not yet available]
                         6- 9 reserved

SAMPLE RATES AVAILABLE

This command requests the sample rates available by the DCE.

Syntax: #VQS
Response: #VQS:(4800, 9600, etc)
                          More values may be added depending on chip set.

CURRENT SAMPLE RATE INQUIRY

       This command requests the current selected sample rate.

Syntax: #VQS?
Response: #VQS=?R
       where R =?   0   4800
                           1   7300 (SC11094 only)
                           2   8000 (SC11092,4 only)
                           3   9600
                           4   11000 (SC11094 only)

CODEC MODE SETUP

This command sets the CODEC mode.

```
Syntax:          #VSM=?C
Response:        OK
      Where C =?        0       8 Mu Law         *** [default]
                        1       8 A-Law          .......[Not yet available]
                        2       8 LIN
                        3       10LIN
                        4       12LIN            .......[SC11094 only]
                        5       14LIN            .......[Not yet available]
                        6       16LIN            .......[Not yet available]
                        7- 9    reserved
```

AVAILABLE CODEC MODES

This command requests the available CODEC modes.

```
Syntax:          #VQM
Response:        VQM:(8 Mu Law, 8LIN, etc)
```

CURRENT CODEC MODE INQUIRY

This command requests the current CODEC mode selected.

```
Syntax:          #VQM?
Response:        #VQM=?C
      Where C =?        0       8 Mu Law
                        1       8 A-Law
                        2       8 LIN
                        3       10 LIN
                        4       12LIN
                        5       14LIN
                        6       16LIN
                        etc
```

COMPRESSION MODE SETUP

This command sets up the compression algorithm.

```
Syntax:          #VSC=?X
Response:        OK
      Where X =?        0       No compression           *** [default]
                        1       CVSD14.4
                        2       ADPCM 32 CCITT G.721    [Not yet available]
                        3       GSM 13                  [Not yet available]
                        4       SPC (Sierra proprietary compression)
                        5       VSELP  (PN2398)         [Not yet available]
                        6       MACE    3:1 (Apple CPU only)
                          [Requires special driver from Sierra]
                        7- 9    reserved
```

COMPRESSION MODES AVAILABLE

This command requests the available compression algorithms.

```
Syntax:          #VQC
Response:        #VQC:(No Compression, CVSD14.4, ADPCM 32,GSM 13, CELP 4, etc
.)
```

CURRENT COMPRESSION MODE INQUIRY

This command requests the current selected compression algorithm.

```
Syntax:          #VQC?
Response:        #VQC=?X
      Where X =?        0        No compression
                        1        CVSD14.4
                        2        ADPCM 32
                        3        GSM 13
                        4        SPC
                      etc as above
```

RELAY CONTROL

The DTE uses an integer, the <X> subparameter, as a label to identify a set
 of relays to energize.

```
Syntax:          #VH=?X
Response:        OK

Where   X =?    0        DCE on-hook.  Relays unenergized.
                         Local phone connected to Telco.
                1        DCE off-hook.  Hook relay energized.
                         DCE connected to Telco.
                2        DCE on-hook.  Local relay energized.
                         Local phone connected to DCE.
                3        DCE off-hook.  Hook and Local energized.
```

Hook status inquiry

```
Syntax:          #VH?
Response:        #VH=?X
      Where X =?any number from 0-3.
```

RINGBACK TIMERS
RINGBACK GOES AWAY TIMER
Syntax: #VRA=?n
Response: OK
      Where n is a value from 1 to 256 representing steps of 100 ms.
      Default value =? 60.

RINGBACK GOES AWAY INQUIREY
Syntax: #VRA?
Response: #VRA=?n

Where n is a value from 1 to 256 representing steps of 100 ms.

RINGBACK NEVER CAME TIMER
Syntax: #VRN=?n
Response: OK
        Where n is a value from 1 to 256 representing steps of 100 ms.
        Default value =? 80.

RINGBACK NEVER CAME INQUIREY
Syntax: #VRN?
Response: #VRN=?n
        Where n is a value from 1 to 256 representing steps of 100 ms.

These timers are used to generate the #VCON response to indicate that a
 remote phone has answered. The #VCON response will be issued when either
 of these timers reaches 0.
E.G. If you expect the call setup to take 10 seconds, and you assume that
 the ring period is 6 seconds, then you would set #VRN=?100 and #VRA=?60.
 If the remote picks up before ringback is generated, #VRN will time out
 first, giving the response #VCON. If one or more ringbacks occur before
 the remote picks up, #VRA will time out 6 seconds after the last ring, (in
 this example), and report #VCON. #VRA will only cause a #VCON response if
 there has been at least one ringback.

SET AUTO ANSWER MODE
It is expected that the user will set S0 to the number of rings required
 before going off hook. When S0 is set to a value other than 0, then the
 modem will automatically go off hook in response to the number of RING
 events specified by S0. It is not recomended to use #VAA with the ATA
 command.
Syntax: #VAA=?n

VAA bit 7 determines fax answer (0) or report only (1)

n	+FAA=?	Answer mode
0	0	Software election
0	1	Fax or Data
1	0 or 1	Fax or Voice
2	0 or 1	Fax, Data or Voice
3	0	Data or Voice
129	0 or 1	Fax/Voice : Report +FCNG (#VDG in voice mode) if Fax, #VCON if voice
130	0 or 1	Fax/Data/Voice: Report +FCNG if fax,
4	0 or 1	Fax/Voice : Report #VDD if Fax, #VCON when the line is automatically taken off hook in response to the number of RING events specified by S0.

Mode 4 (VAA) (Only available in the CORE+ command set)
Mode 4 is valid in voice mode only. Mode 4 is valid only at 11025 s/s.
 #VCON is reported when the line is taken off-hook in response to the number
 of RING   events specified by S0.
The OGM is expected to be played out with a #VSV command at this point. The
 first #VSV executed after an automatic answer will behave as follows:
 1,2,3,4,5,6,7,8,9 and CNG are detectable during the first 4 seconds. 0,1,2
 ,3,4,5,6,7,8,9,*,# are detectable from the end of the first 4 seconds of OGM
 or from the end of the first detected DTMF or CNG tone, until play mode is

exited. DTMF is reported as #VD{number} where {number} may be as specified
 above. CNG is reported as #VDD.

All subsequent #VSV's will behave as described in this document until
 another automatic answer occurs.

CORE+ COMMANDS
CORE+ commands are available on V.22bis modems with 3.15(a-z) series
 firmware, or above.
CORE+ commands are available on V.32bis modems with 2.0 series firmware, or
above.

DTMF QUALIFICATION TIMER
Syntax: S18=?n
Response: OK
Where n is a number representing the number of 10ms intervals the controller
 will use to qualify DTMF.

In Data mode, S18 is the modem test timer. The factory default is 0. When
 the modem enters voice mode, it will save the setting of S18 and set S18 to
 3. The S18 register then becomes the voice mode DTMF detect qualification
 timer.
 DTMF detection is done by the DSP over a period of 15 ms. If at the end of
 this period, DTMF energy is still present, the DSP will report its presense
 to the controller. The controller will further qualify the DTMF for the
 number of 10ms time intervals specified by the S18 register. If S18 is set
 to zero, no qualification of the DTMF will be done by the controller.

DMA DATA TRANSFER
This command instructs the DCE on whether to transfer data via the serial
 port or via a DMA channel. n=?1-3 specifies that data will be transferred
 via DMA. n=?0 specifies that data will be transferred via the serial
 port. Values of n=?1-3 specify specific DMA block transfer rates. The
 default value for n is 0. See appendix D for more information on DMA data
transfers.
SPECIFY DMA DATA TRANSFER RATE
Syntax #VBS=?n
                        n   DMA block transfer size (or mode)
                        0   NO DMA (pass data through serial port)
                                ***[default]
                        1   1K block
                        2   2K block
                        4   4K block

DMA DATA TRANSFER BLOCK SIZES AVAILABLE
This command requests the DMA data block sizes supported by the DCE.
Syntax #VQB
Response   #VQB:(0,1,2,...etc)
        Where the numeric codes are:
                                        0   No DMA
                                        1   1K block
                                        2   2K block
                                        4   4K block
N.B. Block sizes within the list are separated by commas. Block size codes

 are listed in ascending order, starting with 0.

CURRENT DMA DATA TRANSFER BLOCK SIZE
Syntax   #VQB?
Response   n
        Where n is 0,1,2 or 4.
DMA CHANNEL SELECT
Syntax   #VCH=?n
        Where n is 0,1,2, or 3
        The codes for n correspond directly to DMA channels, i.e. code 1 is
 DMA channel 1, etc.
Response   OK

BINARY OFFSET

This command sets the type of binary the voice data will be composed of. If
 AT#VBO=?0, then the DCE shall pass only 2's compliment voice data to the
 DTE; AT#VBO=?0 also implies that the DCE only expects 2's compliment
 voice data from the DTE. Setting AT#VBO=?1 means that the DCE shall pass
 only offset binary voice data to the DTE. AT#VBO=?1 also implies that the
 DCE only expects offset binary voice data from the DTE.

Syntax: #VBO=?M
Response: OK

Where M =?   0   2's compliment ***[default]
                 1   Offset binary

CURRENT BINARY MODE INQUIRY

This command requests the current selected binary mode.

Syntax: #VQO?
Response: #VQO=?M
        Where M =?   0   2's compliment ***[default]
                         1   Offset binary

MICROPHONE COMMAND
This command is used on boards which contain hardware support for an
 external microphone. AT#VM=?0 is the default state and implies that the
 voice stream will be recorded from either the local phone or from the line.
  AT#VM=?1 causes the voice stream to be recorded from the microphone.

Syntax: #VM=?X
Response: OK
        Where X =?   0   Input is from local phone or line. ***[default]
                         1   Input is from microphone.

INPUT SOURCE INQUIRY

Syntax: #VQI?
Response: #VQI=?X
        Where X =?   0   Input is from local phone or line.
                         1   Input is from microphone.

MICROPHONE AVAILABILITY STATUS
This command verifies the presence of microphone firmware. This command
 does not verify presence of microphone hardware.
Syntax: #VQI?
Response: #VQI:X
        Where X =?   0   Microphone is not available.
                          1   Microphone is available.

MONITOR MODE
If supported by your hardware, the monitor command will allow the DCE to
 monitor DTMF energy on the line while in the on-hook state. AT#VSP=?0 is
 the default state and will not report DTMF on the line in the on-hook
 condition. AT#VSP=?1 activates monitor mode and will allow the reporting
 of DTMF on the line while on-hook.
Syntax: #VSP=?X
Response: OK
        Where X =?   0   No Monitoring   ***[default]
                          1   Monitor mode

MONITOR MODE INQUIRY

Syntax: #VQP?
Response: #VQP=?X
        Where X =?   0   No monitoring
                          1   Monitor mode

HOOK BEHAVIOR CONTROL UNDER VOICE
Data and fax calls from within voice mode may be made without dropping the
 line. #VNH controls whether the DCE shall hang up the Telco line if the
 handshake fails or if the DCE performs some other operation that would have
 normally resulted in a hangup of the phone line. #VNH can be used to make
 data or fax connections from within voice calls.

SET HOOK MODE
Syntax: #VNH=?X
        Where X =?   0   Hook behaves normally.
                          1   Line is not dropped after data or fax call.

HOOK MODE INQUIRY
Syntax: #VQH?
Response: #VQH=?X
        Where X=?   0   Normal mode
                          1   No line drop mode.

AUDIO MODE
Audio mode is used to perform "Business Audio" type functions. Audio mode
 is used by the Windows Wave input and output drivers in order to play and
 record 11K uncompressed "Business Audio" type files. Audio mode may also
 be used by applications programs that wish to perform Wave input and output
 operations. Audio mode differs from voice mode in the following ways:

(1) You must have both a DMA and a COM port interface to support Audio Mode.
(2) There is no inband <DLE> signalling in audio mode. The DCE does not

append <DLE> codes to the voice stream during record mode, and the DCE does
 not interpret <DLE> codes within the voice stream on playback. DTMF
 detection is not supported through inband signalling. All result codes are
 passed through the COM port. The voice stream passes through the DMA inter
face.
(3) Playback and record modes can only be aborted manually, i.e. by dropping
 DTR. Playback and record modes can not be aborted by inband signalling or
 by timeouts.
(4) After executing the Audio Mode command, the system defaults are:
        a) #VBS=?4   ;DMA block size of 4K
        b)#VSS=?4   ;Sampling rate of 11.025 K s/s
        c)#VSM=?2   ;Linear mode
        d)#VBO=?1   ;Binary offset mode
(5) Upon executing the Audio Mode command, the current voice mode settings
 are saved. Upon leaving Audio mode, these voice mode settings are restored
.

Syntax: #VZ=?1   ;enter audio mode
              #VZ=?0   ;re-enter voice mode, restoring original settings.
Response: OK

AUDIO MODE INQUIRY
Syntax: #VQZ?
Response: #VQZ=?M
        Where M=?   1   Audio mode
                         0   Voice mode

BUFFER CANCEL ENABLE
This command has two effects.
This command controls the DCE behaviour after reception of a DTMF in
 transmit mode. If n=?0 then when a DTMF tone is received in the voice
 transmit mode, the modem will report the digit, terminate the transmission
 and go into command mode with an OK prompt. When n=?1, then when a DTMF
 tone is received in the voice transmit mode, the modem will report the
 digit but will not terminate the transmission. This first effect only
 occurs when in UART mode, i.e. #VBS=?0.

Effect 1, present in UART mode only:

Syntax: #VC=?n
Response: OK

0   In voice transmit mode, after receiving a DTMF tone, the modem will
 report the digit, terminate the transmission, XOFF the DTE, clear the
 buffer and go to the command mode with an <OK> prompt.

1   In voice transmit mode, after receiving a DTMF tone, the modem will
 report the digit, but will not terminate the transmission. The DTE may at
 any time issue <DLE><CAN> to pause the transmission, clear the buffer and
 resume transmission. The DTE may issue <DLE><ETX> to terminate
 transmission and return to command state.

The DCE will send silence in the case of data underrun.

Effect 2, present in both UART and DMA mode:

#VC controls the buffer cancel enable flag in both UART and DMA mode.

Syntax: #VC=?n
Response: OK

        Where n=?   1   <DLE><CAN> will flush, (throw away), the
                                  voice buffer.
                        0   <DLE><CAN>will not flush the voice buffer.
        Default=?   1

INQUIRE DLE CAN ENABLE
Syntax: #VC=??
Response: #VC=?n
        Where n=?   1   <DLE><CAN>will flush the voice buffer.
                        0   <DLE>.<CAN>will not flush the voice buffer.

CALLER ID

        AT#CCn
                n=?0 CID disabled
                n=?1 Formatted single message data will be decoded and sent
                    to the DTE
                n=?2 Unfomatted data will be streamed to the DTE.

CID COMMAND OUTPUT STRING FORMATS

Ref: TA-NWT-000030
        NIS S107-1

Note that CID commands will work in both voice and data modes.

AT#CC0 CID DISABLE

AT#CC1 CID Enable with formatted output and checksum checking.
                This command only supports single message format.
                Output strings look like:
                <CR><LF>RING<CR><LF>
                DATE=?<SP>05/26<CR><LF>
                TIME=?<SP>15:05<CR><LF>
                CID=?<SP><SP>2146999612<CR><LF>

If the checksum received is not correct, no data will be displayed. If the
 caller is from an area that does not support caller ID, the display will
 show CID=?O. If the caller has suppressed the dial number, you will see
 CID=?P

AT#CC2 CID enable with raw data output:
                <CR><LF>RING<CR><LF>

The raw data format is composed of a series of parameter codes and parameter
 lengths, each of which is followed by some data bytes, the number of which
 is described by the length parameter. There are seven parameters described

in NIS S107-1 Issue 2. E.G. time has a parameter code of 1.

EXAMPLE PARAMETERS USING MULTIPLE MESSAGE FORMAT

Note that the presence of each of these parameters is optional. The lables
 are suggested by NIS S107-1, and appear to be in general use, however
 instance designation is at the discretion of the service provider.

                1   =?   Time
                2   =?   Calling number
                3   =?   Number which must be dialed to reach
                                   calling party
                4   =?   Reason for absence
                5   Reason for redirection
                6   Call qualifier
                7   Name

Appendix A
FLOW CONTROL

PARALLEL MODE FLOW CONTROL -COM PORT MODE
In the parallel application, flow control is achieved through the RXD
 REGISTER EMPTY BIT. The DTE will also set DCD. The routine looks at this
 bit before writing a new byte into the receive register. The bit gets
 cleared every time the CPU reads the RXD BYTE .

CTS from DCE is used for data flow control When the DCE is ready to receive
 the voice data it will set CTS true. When the buffer is at the high mark,
 CTS will go false. When the buffer is at the low mark, CTS will go true.

PARALLEL MODE FLOW CONTROL - DMA PORT MODE
When DMA is used, there is no need for flow control in the DMA channel
 because both the DTE and the DCE are aware of the block size being
 transferred. Individual bytes are not lost because handshaking is
 performed between the DMA controller and the DCE firmware.

SERIAL MODE FLOW CONTROL
 In the serial mode, there is no feedback mechanism like the RXD bit so
 another method of flow control is required. When the DTE accepts a byte,
 the application sends an ACK character to the COM port UART. This is then
 sent to the modem. The modem will detect the ACK and send the next group
 of bytes. (It does not have to wait for the entire character to be
 received, The start bit would be sufficient as the DTE will only send a
 character if it has cleared the UART or if it is requesting a change to
 command state. The latter will be done by <DLE><ETX> or by dropping DTR.
 The DCE will examine the character and identify this after the complete
 character is received.)

The suggested method for using serial mode flow control is as follows: Upon
 receiving an interrupt from the host UART, indicating that the first byte
 from the FIFO is ready to be retrieved, the DTE should disable interrupts
 from the host UART. The DTE should then send an ACK character to the DCE,
 remove the received byte from the host UART and poll the UART line status
 register, watching for the next byte to come in. The DCE will have a new
 byte ready approximately every 30 microseconds. The DTE should draw the
 same number of bytes as set by the #VF FIFO command. After removing the
 last byte, the DTE should re-enable interrupts from the host UART.

Some serial ports include a FIFO (eg.,16C550 or Hayes buffered interface)
 and can store several bytes in the port. . The DCE will send 1 byte to the
 DTE and then wait for <ACK>   (any character will do) Then it will send a
 block of data The number of bytes will be equal to the FIFO parameter set
 by the AT#VF=?xn command.

APPENDIX B
DECEMBER 1993
RESPONSE CODES

General rules in DMA mode for DLE responses:

Responses are shielded and reported differently in different modes.

1) Command mode.

These responses are reported to the UART, without <DLE> shielding:

#VDG,#VTO, #VTH, #VD<NUMBER>, RING, BUSY,#VCON,NO CARRIER, NO DIALTONE

2) Record and playback mode.

These responses are BOTH embedded in DMA data, and reported through the
 UART. The <DLE> shielding is included in both the UART, and the DMA data
 report.

<DLE><ETX>, <DLE>VDT, <DLE>#VD<NUMBER>

These responses are reported through the UART only, with <DLE> shielding.

<DLE>#VTO,<DLE>#VTH, <DLE>RING

These responses are embedded in DMA data only, with <DLE> shielding.
<DLE>L, <DLE><DLE>, <DLE>D, <DLE>R

These responses may be sent in the DMA data stream from the DTE to the DCE
 during playback mode, with <DLE> shielding.

<DLE><CAN> ,<DLE><ETX>

3) Unsupported responses
These responses are not supported in current firmware.

 <DLE><S>, <DLE><Q>

COMMAND MODE RESPONSE CODES

FAX DETECTED

This response is returned when fax calling tones are detected during an
 auto-discriminate answer when using #VAA=?129 or #VAA=?130.
Syntax: #VDG
This response is returned when fax calling tones are detected during an
 auto-discriminate answer when using #VAA=?4.
Syntax: #VDD

LOCAL HOOK CHANGE

This response is returned only when the hook status changes (i.e. from
 on-hook to off-hook or vice versa).

Syntax: #VTO   ;Off-Hook
        #VTH   ;On-Hook

DTMF TONE RECEIVED

This response is returned only when a DTMF tone is received.

Syntax: #VDn
        Where n =? 0,1,2,3,4,5,6,7,8,9,* or # for DTMF

RING RECEIVED
UART mode behaviour.
This response is returned when a ring has been received. The response is
 generated by the on-time or "mark" of the ring signal.
DMA mode behaviour:
This response is retuned when a ring has been received. The ring is assumed
 to be envelope detected, and is qualified by the presence of off time in
 excess of 1 second. This allows distinctive rings to be detected as single
 ring events, and disallows discrimination between different distinctive
 ring types.
Syntax: RING

BUSY RECEIVED
This response is returned when busy tone has been detected on an outbound
 call for 5 seconds.
Syntax: BUSY

VOICE CONNECTION MADE
This response indicates that a voice connection has occured. On incomming
 calls, #VCON indicates, under #VAA rules 129 and 130, that a voice-fax or
 voice-fax-data discrimination has occurred, and that voice has been
 detected.   When #VAA =?4, #VCON indicates that the modem has gone off
 hook in response the number of RING events set by S0. It is expected that
 the #VCON response will be used by DTE applications to know when to begin
 to play the OGM.
On outbound calls, #VCON indicates that the remote side has answered the
 phone. There is no outbound call discrimination between remote voice,
 data, and fax devices.
Syntax: #VCON

REMOTE SIDE NEVER ANSWERED
In voice mode, this response is generated when during an outbound call, the
 period of time set by S7 expires before the remote phone is answered.
Syntax: NO CARRIER

DIALTONE NOT FOUND
This response is generated when during an attempted outbound call, dialtone
 is not detected.
Syntax: NO DIALTONE

EMBEDED <DLE> COMMANDS

END VOICE PLAYBACK
<DLE> <ETX>

Syntax:
<DLE><ETX>
Valid in:
Voice playback mode.
Used for:
Ending voice playback mode by command from DTE. Effect:
Voice playback from the DCE is terminated. The voice command state is
 entered. The data rate is that formerly specified by the #VSn command.

CANCEL BUFFER
<DLE> <CAN>

Syntax:
<DLE><CAN>
Valid in:
Voice playback mode.
Used for:
Clearing the buffer.
Effect:
Voice playback is paused, the buffer is cleared, and voice playback is then
resumed.

EMBEDED <DLE> RESPONSE CODES

REPORT END OF MESSAGE
<DLE><ETX>

Syntax:
<DLE><ETX>
Valid in:
Voice record mode.
Used for:
The DCE uses this to mark the end of a message. <DLE><ETX> is appended to
 the end of voice record files by the DCE. The DCE will recognize the
 <DLE><ETX> sequence on playback and return control from playback mode to
 voice command state.

```
Effect:
Voice command state is entered.
```

```
REPORT DIAL TONE
<DLE>#VDT
```

```
Syntax:
<DLE>#VDT
Valid in:
Voice record mode.
Used for:
Reporting dial tone detection.
Effect:
None.  This is a report only.
```

```
REPORT LOCAL PHONE OFF HOOK
<DLE>#VTO
```

```
Syntax:
<DLE>#VTO
Valid in:
Voice record mode, Voice playback mode.
Used for:
Reporting local phone off hook.
Effect:
None.  This is a report only.
```

```
REPORT LOCAL PHONE ON HOOK
<DLE>#VTH
```

```
Syntax:
<DLE>#VTH
Valid in:
Voice record mode, Voice playback mode.
Used for:
Reporting local phone on hook.
Effect:
None.  This is a report only.
```

```
REPORT RUN LENGTH ENCODING
<DLE>L
```

```
Syntax:
<DLE>L<"byte"><"byte count">
Valid in:
Voice record mode, Voice playback mode.
Used for:
Reporting embedded run length encoding.
Effect:
This indicates that a number, (indicated by "byte count") (in hexadecimal),
 of successive "byte"'s was detected in the voice record stream, and
 replaced by this report.  This is embedded by the DCE during voice record
```

mode. This report is reinterpreted by the DCE during voice playback mode.

REPORT SILENCE DELETION
<DLE>S

Syntax:
<DLE>S
Valid in:
Voice record mode, Voice playback mode
Used for:
Reporting 256 bytes of continuous silence.
Effect:
This indicates that 256 bytes of continuous silence has been replaced in the
 voice record data stream with the report "<DLE>S". The DCE embeds this
 report in voice record mode. The DCE reinterprets this report in voice
 playback mode.

REPORT QUIET DETECTED
<DLE>Q

Syntax:
<DLE>Q
Valid in:
Voice record mode.
Used for:
Reporting that a message contains no voice energy, only quiet. This is
 distinguished from silence, which is the absence of voice energy after
 voice energy is received. Hence a valid message may end in silence, and a
 message reporting quiet may be regarded as not valid.
Effect:
The DCE uses this to mark a recorded voice stream as containing no voice
energy.

REPORT RING
<DLE>RING

Syntax:
<DLE>RING
Valid in:
Voice record mode, Voice playback mode.
Used for:
Reporting an incoming "ring" on the line.

None. This is a report only.

REPORT <DLE>
<DLE><DLE>

Syntax:
<DLE><DLE>
Valid in:
Voice record mode, Voice playback mode.
Used for:
Reporting the occurrence of the character <DLE> within the voice record or

playback stream.
Effect:
The DCE embeds an extra <DLE> with every occurrence of <DLE> in the voice
 record stream. The DCE strips the embedded <DLE> out of the voice playback
 stream as the voice is played back.

REPORT DTMF DEFINITELY DETECTED + IDENTITY
<DLE>#VD<"number">

Syntax
<DLE>#VD<"number">
Valid in:
Voice record mode, Voice playback mode.
Used for:
Reporting the presence and type of detected DTMF in the voice stream. The
 DTE can optionally use this report to help remove DTMF energy from the
 voice stream.
Effect:
The DCE embeds this report at the end of a confirmed DTMF energy burst
 within the voice record stream. "number" can be any of the following: 0-9,
 a-d, or # or *.

REPORT DTMF POSSIBLY DETECTED
<DLE>D

Syntax
<DLE>D
Valid in:
Voice record mode, Voice playback mode.
Used for:
Making a mark as near to the beginning of DTMF energy within the record data
 stream as possible. In playback mode, the DCE will not return any DTMF
 result codes to the DTE during the period after it encounters a DTMF energy
 start marker, (<DLE>D), and before it sees either a DTMF energy release
 marker, (<DLE>R), or a DTMF result code, (<DLE>#VD<"number">). The DTE can
 optionally use this marker to help remove DTMF from the voice stream.
Effect:
This report is embedded in the voice record stream as near as possible to
 the beginning of DTMF energy.

REPORT RELEASED DTMF DETECTION
<DLE>R

Syntax
<DLE>R
Valid in:
Voice record mode, Voice playback mode.
Used for:
Canceling the report of a detected DTMF. This marker indicates that the DCE
 did not detect DTMF for a valid length of time. In playback mode, the DCE
 will not return any DTMF result codes to the DTE during the period after it
 encounters a DTMF energy start marker, (<DLE>D), and before it sees either
 a DTMF energy release marker, (<DLE>R), or a DTMF result code,
 (<DLE>#VD<"number">). The DTE can optionally use this marker to help remove

 DTMF from the voice stream.
Effect:
This report is embedded in the voice record stream if detected DTMF energy=
 does not last for a valid length of time.

APPENDIX C
TEST SCRIPT
One of the best ways to test out the hardware is through the use of test
 scripts run through a terminal emulation program such as PROCOM. Using
 test scripts you can play and record with VoDaFax quite successfully.
 Because the scripts are interpreted through the terminal emulator, speed is
 an issue. Fast hardisks (15 milliseconds access time) or ram drives are
 the best media to play and record from. Using a 486DX-33 or better is also
 helpful, though a 386DX-33 should be sufficient.

SIMPLE VOICE RECORD AND PLAYBACK FROM THE LOCAL PHONE

ATZ   ;Reset the modem
AT#VS2   ;Set the data rate to 57600 bps.
Set the terminal emulator to a data rate of 57600 bps.
AT#VF=?0   ;Turn off flow control for this simple example.
AT#VSS=?0   ;Set the sampling rate at 4800 samples per second.
AT#VSC=?0   ;Turn off compression.
AT#VSM=?0   ;Set codec mode to mu-law.
AT#VH=?2   ;Energize the local phone relay.
AT#VD1   ;Record voice
Set the terminal emulator to download a file in raw ascii to a filename.
End the message by not speaking for several seconds. The ascii characters
 for <DLE><ETX> will be displayed followed by OK when the DCE detects silence.
AT#VD0   ;Playback voice
Set the terminal emulator to upload a file from the filename previously
specified.

Try modifying this simple example by changing the sample rate to get a
 better quality recording. Always choose a data rate equal to or greater
 than the sample rate in bytes /s X 10 in bps. E.G. if you choose 9600
 samples per second uncompressed, you need a data rate of 9600 X 10 bps ?=
 96000 bps, so set the data rate at #VS1 for 115200 bps. If you use
 compression, account for the compression before you multiply by 10. E.G.
 4800 samples per second with SPC 2:1 compression needs a data rate of
 4800/2 * 10 =? 24000 bps, so choose #VS3 for 38400 bps. You must always
 allow for interrupt latency, so be sure to choose a data rate which is more
 than sufficient for the sampling rate you choose.

APPENDIX D
DMA HANDSHAKING

The following is a description of how to use the VoDaFax DMA interface.
Overview

The purpose of the VoDaFax DMA interface is to allow uncompressed voice data

to be transferred between the modem and the host computer without data loss
or degradation of system performance. The DMA interface currently only
supports voice data. All voice commands and result codes as well as fax and
data commands operate normally through the UART.

Initializing The Modem For DMA Transfers

This modem must be initialized properly to order to support DMA operation.
There are two commands which support the DMA operation, AT#VCH and AT#VBS.

The AT#VCH selects the DMA channel to be used. The VoDaFax demo board
provides for a software programmable DMA channel, eliminating the need for
switch settings. AT#VCH=?1 selects DMA Channel 1 and AT#VCH=?3 selects
DMA Channel 3. These are both 8-bit DMA channels and are found on all PC
systems.

The AT#VBS command sets the DMA block size and enables/disables DMA
operation. AT#VBS=?0 disables DMA operation and sets up the modem to
transfer voice data through the UART. AT#VBS=?1, AT#VBS=?2 and AT#VBS=?4
select DMA block sizes of 1K, 2K and 4K bytes respectively. On the VoDaFax
demo board the AT#VBS=?0 command will tri-state the DRQ signal on the PC
bus, enabling another board to use either DMA Channel 1 or DMA Channel 3.

Initialization of the modem for voice mode is completed by sending the
appropriate VoDaFax voice commands to select the required voice operation
(i.e. sample rate, compression, etc.)

DMA Handshaking

Each block of voice data is transferred to and from the host system under
control of the host system. The CTS and RTS signals in the UART are used to
supervise the transfer. The host must initiate the transfer of each block
of data by setting the RTS signal to 1. The modem indicates a DMA transfer
is underway by setting its CTS signal to 1 during the transfer of the data,
and clearing the CTS signal when the selected number of bytes have been
transferred. The host signals the end of a multiblock DMA transfer by
setting the DTR signal to 0. The following example shows how the DMA
transfer works