APPLICATION NOTE

Conduct a 23-Tone Responder Test Over an ATM Network, Gateway (Class 4) Switch to Gateway (Class 4) Switch

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SAGE INSTRUMENTS, 240 AIRPORT BLVD., FREEDOM, CA 95019-2614 (831) 761-1000 CUSTOMER SERVICE FAX: (831) 761-6318

Introduction

This document describes a suggested method of conducting a 23-Tone responder test between two ATM gateway switches, using a pair of Sage Model 930A Communications Test Sets. It assumes the 930A test access is at a T1 point, where each 930A terminates a full T1 (See ***Figure 1***, below). It also assumes the DS0 circuit over which the test call is placed uses robbed-bit signaling, and employs wink-start signaling supervision and MF (or DTMF or Dial-Pulse) addressing. If the T1 transmission path does not support end-to-end robbed-bit signaling, you will have to use an alternative method of "seizing" the far-end 930A. Such a method is covered in Appendix A.

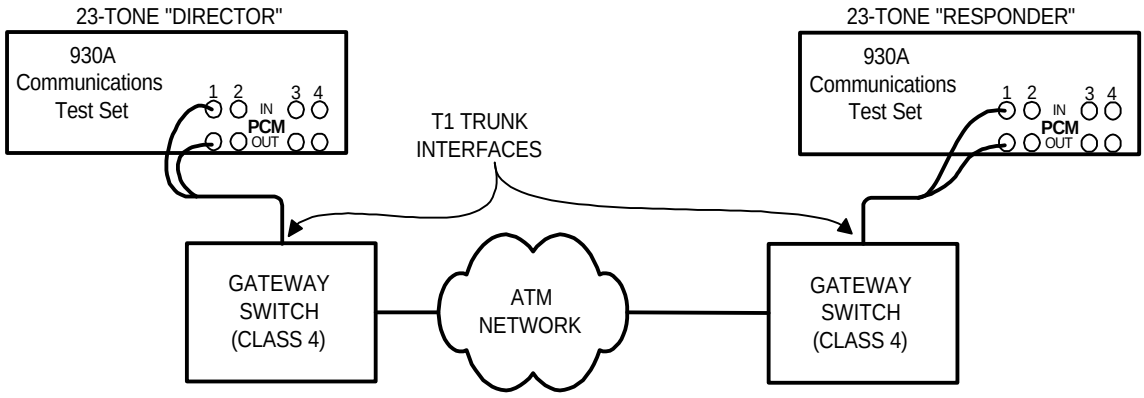

Figure 1 — VoATM 23-Tone Test Architecture

Preparing the 930A for Automatic Logging of Test Results

By configuring the 930A Remote Control function for "Printer" mode, you can have it automatically print the 23-Tone test results to your PC.

1. Press the Option Menu button three (3) times to insure you completely back out of any other menu. Then, using the numeric keypad, enter "3", then press the grey "ENT" button. Your display should now look something like the example below:

```
REMOTE MODE:       OFF    SET-UP    EXIT
```

2. Repeatedly press Softkey 2 until you see "PRINTER". The display should now look like the illustration below:

```
REMOTE MODE:     PRINTER  SET-UP    EXIT
```

3. Press Softkey 3 (SET-UP). The display will change to one like the sample below:

```
SELECT    BAUD RT  PARITY  BIT#      EXIT
```

4. Press Softkey 1 (BAUD RT). The 930A will now display something like the illustration below:

```
SET BAUD RATE:    38400
```

5. Using the numeric keypad, enter the desired baud rate. You may enter 1200, 2400, 9600, 19200 or 38400. Users typically enter 9600, finding the speed quite adequate. Close out the baud rate entry by

pressing the grey "ENT" button located at the bottom right of the numeric keypad. Once you press the ENT button, the display will return to the initial selection screen, as shown below:

```
SELECT   BAUD RT  PARITY  BIT#     EXIT
```

6. Press Softkey 2 (PARITY). The 930A will display the parity options, as illustrated below:

```
PARITY:           NONE    EVEN    ODD
```

7. Most users select "NONE"; however, you may press Softkey 2, 3 or 4 to select the desired parity mode. Once you have pressed the desired Softkey, you will be once again returned to the opening selection screen:

```
SELECT   BAUD RT  PARITY  BIT#     EXIT
```

8. Press Softkey 3 (BIT). The 930A will display choices for the number of data bits per character, as illustrated below:

```
BITS PER CHARACTER:  7              8
```

9. Most users select "8"; you may make your selection by pressing Softkey 2 or 4. Once you have made your selection, the 930A moves on to display choices for the number of stop bits:

```
STOP BITS:          1     1-1/2     2
```

10. Most users select "1"; you may make your selection by pressing Softkeys 2, 3 or 4. When you have made your selection, the 930A returns you to the opening selection screen:

```
SELECT   BAUD RT  PARITY  BIT#     EXIT
```

11. Press Softkey 4 (EXIT). The 930A will now display the opening "Remote Mode" screen:

```
REMOTE MODE:     PRINTER  SET-UP   EXIT
```

12. Press Softkey 4 (EXIT). The 930A will prompt you with the first of four successive questions before exiting the Remote Mode setup function. Your display should now look like the example below:

```
PRINT  ERRORS?              YES      NO
```

13. If you press Softkey 3 (YES), the 930A will automatically "print" a time/date stamped 2-line report each time a detected PCM error occurs (No PCM, Frame Loss, Frame Error, Slip, Bipolar Violation,

Remote Alarm, Blue Alarm (ESF), CRC Error (ESF), or >15 Zeros). Press Softkey 3 (YES) or 4 (NO). The 930A will advance to the 2nd question, as illustrated below:

```
PRINT  RECEIVED RECORDS?   YES      NO
```

14. This option has no effect except when using the Menu Option 4 (Digit Receiver) function. If you press Softkey 3 (YES), the 930A will automatically "print" the received string of digits in the form: "**0123456789#*ABCD REC#N HOLD DTMF**". Press Softkey 3 (YES) or 4 (NO). If you select "NO", go t 16, because the 930A will skip the 3rd question, which is illustrated below:

```
PRINT  DIGIT ANALYSIS?     YES      NO
```

15. This option has no effect except when using the Menu Option 4 (Digit Receiver) function. If you press Softkey 3 (YES), the 930A will automatically "print", for each digit, the frequency and amplitude of each MF or DTMF tone together with the Interdigit time, as well as up to two spurious tones. Dial Pulse digits are analyzed in terms of % Break, Pulses per second and Interdigit time. Press Softkey 3 (YES) or 4 (NO). The 930A will advance to the 4th question, as illustrated below:

```
PRINT  WINK TIMING?        YES      NO
```

16. This option has no effect except when using the Menu Option 4 (Digit Receiver) or Menu Option 2 (Send Digit Sequences) functions. If you press Softkey 3 (YES), and the "Sequence" parameter in either function contains a "W" (Wink), the 930A will automatically "print" a time/date stamped report of the wink Guard and duration times. Press Softkey 3 (YES) or 4 (NO). Once you have made your selection, the 930A returns to the opening Remote Control display, as shown below:

```
OPTION MENU #:  3 REMOTE CONTROL
```

Note: When connecting a PC to the 930A remember to use a ***straight-through***, NOT null-modem cable.

Configuring the 930A to use a T1 Interface *(Applies to both Director and Responder Units)*

1. Repeatedly press the TRUNK TYPE button (top left black button on the front panel) until the red LED beside it illuminates. Note that three quick pushes of the Trunk Type button will force the 930A to this function, regardless of what menu it may have been in. You will see a display which may resemble the example below:

```
     NORMAL  LOOP  BRIDGE  CONTACT 2W 900
```

2. Repeatedly press the Down-Arrow (▼) button until you see a display like the one below:

```
OPTIONAL TYPES:    PCM     SF   WIDEBAND
```


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3. Press Softkey 2 (located directly under "PCM"). The display should now resemble the example below:

```
CH# 22   RECV-1   TERM   EXT CLK  SET-UP
```

4. If "**TERM**" is displayed above Softkey 2, go to Step 6. Otherwise, press Softkey 2. The display should now look like the one below:

```
SPAN: TERMINATE   MON-1  MON-1&2   D&I
```

5. Press Softkey 1 (TERMINATE). The display should now resemble the sample below:

```
CH# 22   RECV-1   TERM   EXT CLK  SET-UP
```

6. Press Softkey 4 (Set-Up). The display will change to look like the one below:

```
IMPEDANCE:       100 OHM          >1K OHM
```

7. Press Softkey 2 (100 Ohm). The display will now look like the illustration below:

```
FRAMING:    AUTO  D4/SF    ESF    SLC-96
```

8. If the access T1 employs D4/Superframe framing, press Softkey 2; if it uses Extended Superframe format, press Softkey 3. The display will change to look like the one below:

```
SIGNALING:    ROBBED-BIT   CLEAR-CHANNEL
```

9. Press Softkey 2 (Robbed-Bit). The display will now resemble the example below.

Notes:

1. If your 930A does not have Purchase Option 930A-69 (VF encoding Select), "µLAW" will not be displayed.

2. If the test access T1 at the "23-Tone Responder" end isn't optioned for Robbed-Bit signaling (perhaps because supervision info is being carried over an SS7 network), the "Director" 930A won't be able to directly "seize" the far end 930A "23-Tone Responder", therefore the responder won't answer. In such cases you will have to alternatively "seize" the Responder using a special Sage DTMF dial string, as discussed in Appendix A.

```
CODING:   uLAW     AMI   AUTO-B8  B8ZS
```

10. If your 930A does not display "µLAW", proceed to step 11. Otherwise, press Softkey 1 to toggle between "µLAW" and "aLAW". Note that µ-Law encode/decode is the type normally employed in North America.

11. If the test access T1 is configured for AMI Line Coding, press Softkey 2 (AMI); if the T1 uses B8ZS Line Coding, press Softkey 4 (B8ZS). The 930A display should now change to look like the illustration below:

```
CHANNEL SEQUENCE: D3/D4    D1D     D2
```

12. If the test access T1 uses standard sequential 1-through-24 channel numbering, press Softkey 2 (D3/D4). Otherwise, press the appropriate Softkey to select D1D or D2. Your display should now look like the example below:

```
S'VSN:   DEFINED  NORMAL   FXS     FXO
```

13. Press Softkey 2 (Normal). The display should change to look like the one below:

```
CH# 22   RECV-1   TERM   EXT CLK  SET-UP
```

14. Select the desired DS-0 channel by either using the Up (▲) and Down (▼) arrow keys, or directly enter the channel number using the 930A front panel numeric keypad. If you use the numeric keypad, complete the number entry by pressing the grey "ENT" button located at the bottom right of the numeric pad.

Configuring the 930A 23-Tone Responder Function (Menu Option 69)

1. Press the Option Menu button three (3) times to insure you completely back out of any other menu. Then, using the numeric keypad, enter "4", then press the grey "ENT" button. Your display should now look something like the example below:

```
          SET-UP RECEIVE ANALYZE   EXIT
```

2. Press Softkey 1 (SET-UP). The display should change to the one shown below:

```
SET RECEIVE:  PARAMETERS SEQUENCE  EXIT
```

3. Press Softkey 2 (PARAMETERS). The display should now look something like the example below:

```
RECORD: 1     18 DIGITS     MF     EXIT
```

4. Press Softkey 3 to cycle through "MF", "DTMF" and "DP" (Dial Pulse) to select the *type* of digits you expect the 930A to receive. Then, using the numeric keypad, enter the *quantity* of digits it should expect. When you are done, the display should look something like the illustration below:

```
RECORD: 1     7 DIGITS     MF     EXIT
```

5. Press Softkey 4 (EXIT). The display should return to the opening Digit Receiver Setup screen, as shown below:

```
SET RECEIVE:  PARAMETERS SEQUENCE  EXIT
```

6. Press Softkey 3 (SEQUENCE). The display should change to look something like the illustration below:

```
                    WINK   OFF-HK   MORE
```

7. If there are any characters to the left of "WINK", press the grey "CLR" button located to the right of the numeric keypad. Now, press Softkey 2 (WINK). This will create a "W" to the left of "WINK", as shown below:

```
                  W WINK   OFF-HK   MORE
```

8. Using the numeric keypad, enter the "RECORD" number where we specified the type and quantity of digits to expect. In this example, we specified those parameters in Record 1. So, using the numeric keypad, enter "1", then press the grey "ENT" button located near the bottom left of the numeric keypad. The display should now resemble the example below:

```
                W 1 WINK   OFF-HK   MORE
```

9. Press Softkey 4 (MORE). The display will change to look like the one below:

```
                W 1 PAUSE D-DIAL TESTLINE
```

10. Press Softkey 4 (TESTLINE). The display will now look like the illustration below:

```
TESTLINE:  100     102     105  LOOPBACK
```

11. Press the right-arrow button. The display will change to the one shown below:

```
TESTLINE:  PSQM   ATME  23-TONES   MORE
```

12. Press Softkey 3 (23-TONES). The display will change to look like the one below:

```
             W 1 TT WINK   OFF-HK   MORE
```

13. Now, press the Option Menu button TWO TIMES to back up two levels of the 930A's menu structure. The display should now resemble the illustration below:

```
          SET-UP RECEIVE ANALYZE   EXIT
```


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14. To "arm" the 930A to receive a call, press Softkey 2 (RECEIVE). The display will change to look like the example below:

```
                    REC#1   HOLD   GATED
```

15. At this point, the 23-Tone "Responder" 930A is ready to receive a call.

Configuring the 930A 23-Tone Director Function (Menu Option 70)

1. Insure the 930A front panel On-/Off-Hook switch (often called the "hook switch") is in the On-Hook position.

2. Press the Option Menu button three (3) times to insure you completely back out of any other menu. Then, using the numeric keypad, enter "70", then press the grey "ENT" button. Your display should now look like the example below:

```
23 TONE DIRECTOR: TEST   SET-UP  RESULTS
```

3. Press Softkey 3 (Setup). The display will change to look like the one below.

```
SEND LEVEL:      -16.0 dBm
```

4. This screen allows you to set the level of the composite waveform resulting from simultaneously transmitting 23-tones. The default is -16.0 dBm. The allowable range is -40 dBm to -6 dBm, which is the maximum to prevent clipping on PCM facilities. Using the numeric keypad, enter the desired transmit level, then press the grey "ENT" button located near the bottom right of the numeric keypad. The display will return to the opening 23Tone screen, as illustrated below:

```
23 TONE DIRECTOR: TEST   SET-UP  RESULTS
```

5. This completes setup of the 930A 23-Tone Director function.

Programming the 23-Tone Director's Wink-Start Dialing Sequence

In this section, we will first store the desired dialing digits in a 930A memory register. Then, we will program a dialing sequence which will instruct the 930A to, upon seizing a circuit, wait for a return "wink" from the far end, then transmit the dial digits we previously stored, then initiate the 23-Tone test.

1. Press the Dial/Ring button. The display should change to resemble the example below:

```
                    RPT?     MF     PCM1
```

2. If there are any digits to the left of "RPT?", press the grey "CLR" button located at the right of the numeric keypad. Now, press Softkey 3 to cycle through "MF", "DTMF" and "DP" (Dial Pulse) to select the type of digits you want the 930A to dial. Then, using the numeric keypad, enter the desired string of digits. When you are done, the display should look something like the illustration below:

```
        8005551212 RPT?     MF     PCM1
```

3. Press the grey "STO" button located at the right of the numeric keypad. The display should then prompt for the memory register number you want to use, as illustrated below:

```
STORE  TEST#   2  [999 TO ESC]
```

4. Using the numeric keypad, enter "1", then press the grey "ENT" (enter) button located at the bottom right of the numeric keypad. The display will return to the last Dial/Ring display, as shown below:

```
        8005551212 RPT?     MF     PCM1
```

5. Press the Option Menu button three (3) times to insure you completely back out of any other menu. Then, using the numeric keypad, enter "2", then press the grey "ENT" button. Your display should now look something like the example below:

```
AUTO REPEAT?      YES                NO
```

6. Press Softkey 4 (NO). The display will advance to the next screen, as illustrated below:

```
                    WINK   OFF-HK   MORE
```

7. If there are any characters to the left of "WINK", press the grey "CLR" button located to the right of the numeric keypad. Now, press Softkey 2 (WINK). This will create a "W" to the left of "WINK", as shown below:

```
                  W WINK   OFF-HK   MORE
```

8. Using the numeric keypad, enter the memory register number where you stored the digit string to dial. In this example, we had stored 8005551212 in register 1. So, using the numeric keypad, enter "1", then press the grey "ENT" key located at the bottom right of the numeric keypad. The display should now look like the example below:

```
                W 1 WINK   OFF-HK   MORE
```

9. Now, press Softkey 4 (MORE). The display should present the next screen, as illustrated below:

```
                W 1 PAUSE  D-DIAL  MORE
```

10. Press Softkey 4 (MORE), again. The display advance to the next screen, as shown in the example below:

```
                W 1 SEND  TESTLINE  EXIT
```

11. Press Softkey 3 (TESTLINE). The display will then look like the illustration below:

```
TESTLINE:  CPROG   102     105     MORE
```

12. Press Softkey 4 (MORE), again. The display should now look like the example below:

```
TESTLINE:  PSQM   ATME  23-TONES   MORE
```

13. Press Softkey 3 (23-TONES). The display will change to one like the illustration below:

```
             W 1 TT WINK   OFF-HK   MORE
```

14. If the 23-Tone Responder function at the far end is ready to accept a call, you can initiate one now, by simply flipping the Director's front panel "hook" switch to the Off-Hook position.

This Application Note is made available as a courtesy to our customers, in the hope it will be helpful. However, it is provided "as is" without warranty of any kind, either express or implied.

Sample Printout of 23-Tone Test Results:

```
 CALL COMPLETION TIME:    1.8 SEC.  13:12

     Wednesday  11-03-99 13:12:21


NEAR RESULTS

TONE#     FREQ    LEVEL         FREQ      DELAY
--------------------------   -------------------
TONE#1    203Hz  -29.6dBm       281Hz      5usec
TONE#2    359Hz  -29.7dBm       438Hz     -6usec
TONE#3    516Hz  -29.6dBm       594Hz     -5usec
TONE#4    672Hz  -29.5dBm       750Hz     -1usec
TONE#5    828Hz  -29.6dBm       906Hz     -6usec
TONE#6    984Hz  -29.6dBm      1063Hz      0usec
TONE#7   1141Hz  -29.6dBm      1219Hz     -2usec
TONE#8   1297Hz  -29.6dBm      1375Hz    -12usec
TONE#9   1453Hz  -29.6dBm      1531Hz     -6usec
TONE#10  1609Hz  -29.6dBm      1688Hz     -5usec
TONE#11  1766Hz  -29.7dBm      1844Hz     -3usec
TONE#12  1922Hz  -29.7dBm      2000Hz      2usec
TONE#13  2078Hz  -29.6dBm      2156Hz     -8usec
TONE#14  2234Hz  -29.6dBm      2313Hz     -1usec
TONE#15  2391Hz  -29.6dBm      2469Hz     -1usec
TONE#16  2547Hz  -29.6dBm      2625Hz     -6usec
TONE#17  2703Hz  -29.6dBm      2781Hz     -9usec
TONE#18  2859Hz  -29.7dBm      2938Hz      2usec
TONE#19  3016Hz  -29.6dBm      3094Hz     -9usec
TONE#20  3172Hz  -29.6dBm      3250Hz     -3usec
TONE#21  3328Hz  -29.7dBm      3406Hz     -1usec
TONE#22  3484Hz  -29.6dBm      3563Hz     -4usec
TONE#23  3641Hz  -29.6dBm

LEVEL:-16.0dBm
NOISE: S/TD 38dB  S/N 38dB
S/IMD: 2nd  45dB  3rd 43dB


FAR RESULTS

TONE#     FREQ    LEVEL         FREQ      DELAY
--------------------------   -------------------
TONE#1    203Hz  -29.6dBm       281Hz      5usec
TONE#2    359Hz  -29.7dBm       438Hz    -10usec
TONE#3    516Hz  -29.6dBm       594Hz    -12usec
TONE#4    672Hz  -29.6dBm       750Hz     -7usec
TONE#5    828Hz  -29.6dBm       906Hz     -8usec
TONE#6    984Hz  -29.6dBm      1063Hz      0usec
TONE#7   1141Hz  -29.7dBm      1219Hz     -5usec
TONE#8   1297Hz  -29.6dBm      1375Hz    -15usec
TONE#9   1453Hz  -29.6dBm      1531Hz    -11usec
TONE#10  1609Hz  -29.7dBm      1688Hz     -2usec
TONE#11  1766Hz  -29.6dBm      1844Hz    -11usec
TONE#12  1922Hz  -29.7dBm      2000Hz      2usec
TONE#13  2078Hz  -29.6dBm      2156Hz    -11usec
TONE#14  2234Hz  -29.6dBm      2313Hz     -1usec
TONE#15  2391Hz  -29.6dBm      2469Hz     -7usec
TONE#16  2547Hz  -29.6dBm      2625Hz    -10usec
TONE#17  2703Hz  -29.6dBm      2781Hz    -11usec
TONE#18  2859Hz  -29.7dBm      2938Hz     -1usec
TONE#19  3016Hz  -29.6dBm      3094Hz     -8usec
TONE#20  3172Hz  -29.5dBm      3250Hz    -12usec
TONE#21  3328Hz  -29.6dBm      3406Hz     -3usec
TONE#22  3484Hz  -29.6dBm      3563Hz     -7usec
TONE#23  3641Hz  -29.6dBm

LEVEL:-16.0dBm
NOISE: S/TD 37dB  S/N 37dB
S/IMD: 2nd  44dB  3rd 42dB

     Wednesday  11-03-99 13:12:26

EVENT#1
          W 1 TT    220  msec   GUARD
          W 1 TT    149  msec    WINK
```

APPENDIX A

What to Do if the Network Doesn't Support End-to-End Signaling Between Director & Responder?

Introduction

If the network under test doesn't support end-to-end signaling, the far end "Responder" 930A won't be able to detect a "call" from the 23-Tone "Director" 930A — So, it will never answer the call. Such a situation could occur when the circuit under test is an "SS7 trunk" whose On-/Off-hook supervision information is carried over an SS7 network instead of T1 AB-bit signaling on the trunk under test. This Appendix describes how to get around this problem.

Configure the "Director" and "Responder" 930A's for Clear Channel

Configure the 930A T1 Interfaces as described in ***Configuring the 930A to use a T1 Interface***, BUT in step 9, press Softkey 4 (CLEAR-CHANNEL) instead of Softkey 2 (ROBBED-BIT).

Ignore Wink-Start Dialing Sequence

Don't bother setting up a Wink-Start dialing sequence as described in the ***Programming the 23-Tone Director's Wink-Start Dialing Sequence*** section of this document.

Dial DTMF "7243" (SAGE)

Add the following steps to the end of the ***Configuring the 930A 23-Tone Director Function (Menu Option 70)*** section of this document:

1. Press Softkey 2 (TEST). The display will now change to look something like the example below:

```
ENTER  23 ACCESS #    DTMF
```

2. If "DTMF" is not displayed above Softkey 4, repeatedly press Softkey 4 until "DTMF" is displayed. Then, using the numeric keypad, enter "7243" (SAGE). When you are done, the display should look like the illustration below:

```
7243  23 ACCESS #    DTMF
```

3. By whatever means necessary, set up a voice-path connection between the 23-Tone "Director" and "Responder" 930A's. Once that path is present, flip the 930A front panel "hook" switch to the Off-Hook position. The 930A will automatically outpulse the DTMF digits "7243". Upon receiving the digits, the "Responder" 930A will return a 2225 Hz Test Progress Tone and the test will commence.