
◀||| *APPLICATION NOTE* |||▶

**Over an ATM Network, Conduct a PSQM Responder Test
Gateway (Class 4) Switch to Gateway (Class 4) Switch**

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What Is PSQM?

PSQM stands for Perceptual Speech Quality Measurement. The PSQM test is based on the ITU-T P.861 and P.50 recommendations. The ITU (International Telecommunication Union), headquartered in Geneva, Switzerland is an international organization within which governments and the private sector coordinate global telecom networks and services.

P.861 defines a method for estimating the subjective quality of voice-band speech codecs. It is designed to measure the quality of voice channels, especially where traditional Transmission Impairment Measurements (TIMS) cannot be used. The method is based on research in human psycho-acoustic perception. It assigns an objective figure of merit to a voice channel that is equivalent to that which would be assigned by surveying real human listeners.

P.50 defines an artificial voice for use in PSQM tests. It includes both genders (male and female), and is aimed at reproducing the essential characteristics of human speech for transmission testing. Those characteristics include the long-term average spectrum, short term spectrum, instantaneous amplitude distribution, voiced and unvoiced structure of speech waveform and syllabic envelope.

The PSQM test has been shown to correlate very well with Mean Opinion Scores derived from actual listeners. The output of the PSQM algorithm is called the PSQM value. It indicates the degree of quality degradation caused by the whole communication system under test. The PSQM value has a range from 0 to 6.5. 0 means no degradation (perfect quality), whereas 6.5 indicates the highest degradation. An MOS score has a range from 1 to 5 and is inversely proportional to the PSQM value. MOS 5 means excellent speech quality, whereas MOS 1 indicates the worst.

Introduction

This instruction assumes the 930A test access is at a T1 point, where the 930A terminates the 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](#).

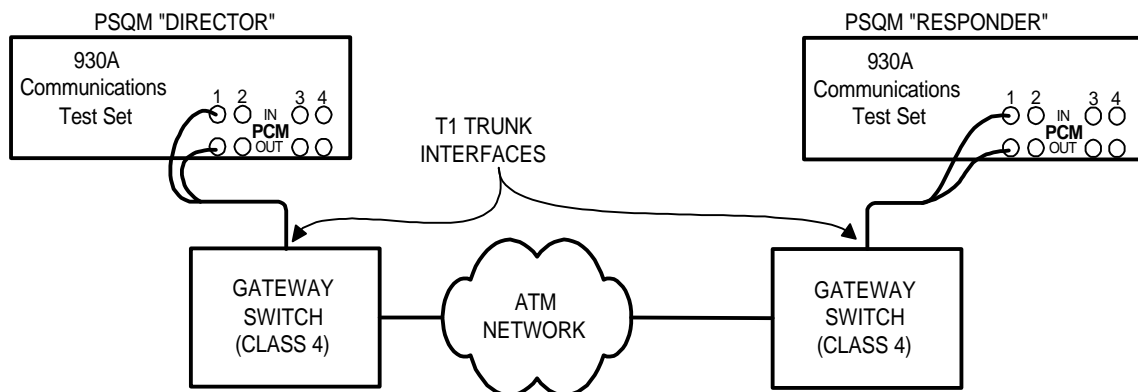


Figure 1 — VoATM PSQM Test Architecture

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 PSQM 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 to 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

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 "PSQM 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 "PSQM 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 PSQM Responder Function (Menu Option 53)

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 1 (PSQM). The display will change to look like the one below:

W 1 TQ 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

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 PSQM "Responder" 930A is ready to receive a call.

Configuring the 930A PSQM Director Function (Menu Option 52)

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 "52", then press the grey "ENT" button. Your display should now look like the example below:

PSQM DIRECTOR TEST SET-UP RESULTS

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

PSQM SETTINGS: DEFAULT CHANGE EXIT

- If you DON'T want to use the defaults of *Duration* = 10 seconds, *Talk Speed* = medium and *Gender* = Male, go to Step 6. Otherwise press Softkey 2 (Default). The display will now look like the example below:

```

SET DEFAULTS?          YES      NO
  
```

- Press Softkey 3 (Yes). The display will return to the "settings" screen, as illustrated below. Now, go to Step 11.

```

PSQM SETTINGS:  DEFAULT  CHANGE  EXIT
  
```

- If you want to modify PSQM settings to be different from the defaults of *Duration* = 10 seconds, *Talk Speed* = medium and *Gender* = Male, press Softkey 3 (CHANGE). The display will now look like the example below:

```

DURATION: 10s  TALK-SPEED: MEDIUM  MORE
  
```

- To change the DURATION of the synthetic speech used in the PSQM test, use the numeric keypad to enter the desired duration (Valid durations are between **1** and **19** seconds). To change the TALK-SPEED, repeatedly press Softkey 3 to cycle through SLOW, MEDIUM and FAST.

Once you have set the DURATION and SPEED, press Softkey 4 (MORE). The display will change to resemble the illustration below:

```

GENDER: MALE          MORE
  
```

- You can press Softkey 1 to toggle between MALE and FEMALE "genders" of synthetic speech. Once the desired gender is displayed, press Softkey 4 (MORE). The display will change to resemble the example below:

```

SET TLP:           0 dB      USER  -2 dB
  
```

- If you want to set both Transmit and Receive TLP's to 0 dBm, press Softkey 2 (0 dBm), then go to Step 11. If you want to set them for -2 dBm, press Softkey 4 (-2 dBm), then go to Step 11. If you want different TLP values or want to set independent TLP's for Transmit and Receive, press Softkey 3 (USER). The display will then change to resemble the illustration below:

```

SEND:   +0.0 dBm  RECV:  +0.0 dBm  EXIT
  
```

- To set the SEND TLP, press Softkey 1, then use the numeric keypad to enter the desired level. To Set the RECV TLP, press Softkey 3, then use the numeric keypad to enter the desired level. Once the TLP's are set to your satisfaction, press Softkey 4 (EXIT). The display will then return to the opening setup screen, as in the example below:

```

PSQM SETTINGS:  DEFAULT  CHANGE  EXIT
  
```

11. Press Softkey 4 (EXIT). The display will return to the PSQM opening screen, as illustrated below:



12. This completes setup of the 930A PSQM Director function.

Programming the PSQM 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 a PSQM test.

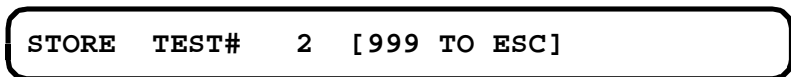
1. Press the Dial/Ring button. The display should change to resemble the example below:



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:



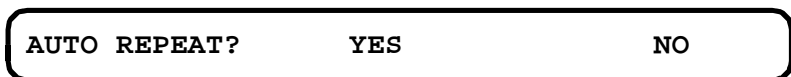
3. Press the grey "STO" button located at the right of the numeric keypad. The display should then prompt for the memory register number you want to use, as illustrated below:



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:



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:



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



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 1 (PSQM). The display will change to one like the illustration below:

W 1 TQ WINK OFF-HK MORE

14. If the PSQM 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.

Sample Printout of PSQM Test Results:

```
----- PSQM REPORT -----
DURATION: 10s           TALK-SPEED: MEDIUM
GENDER: MALE
SEND TLP:  +0.0         RECV TLP:  +0.0

NEAR to FAR: 0.13psqm   4.90mos   +0.0dB
FAR to NEAR: 0.13psqm   4.90mos   +0.0dB
DELAY:  0.0ms

>
    Wednesday 10-27-99 19:00:04

EVENT#1
      W 1 TQ      222 msec   GUARD
      W 1 TQ      157 msec   WINK
```

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.

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 PSQM "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 PSQM Director's Wink-Start Dialing Sequence](#) section of this document.

Dial DTMF "7243" (SAGE)

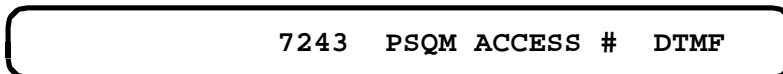
Add the following steps to the end of the [Configuring the 930A PSQM Director Function \(Menu Option 52\)](#) section of this document:

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



A screenshot of a device display showing the text "ENTER PSQM ACCESS # MF" centered within a rounded rectangular border.

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:



A screenshot of a device display showing the text "7243 PSQM ACCESS # DTMF" centered within a rounded rectangular border.

3. By whatever means necessary, set up a voice-path connection between the PSQM "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 output the DTMF digits "7243". Upon receiving the digits, the "Responder" 930A will start the PSQM answer sequence and the test will commence.