

Packet Voice Impairment Test (PVIT) on the Sage 930A-L3, 930i, and 935AT

The Sage Packet Voice Impairment Test (PVIT) provides detailed diagnostic information about events that impact voice clarity over packet switched networks. These potentially degrading events include:

- Voice frame losses
- Voice frame slips (also known as jitters)
- Voice clippings
- Noise hits

PVIT works by sending a complex test signal over the network, and measuring events that degrade that signal. The test:

- Measures four types of impairment events
- Displays cumulative event counts in real time
- Displays details about events as they occur
- Accumulates data over the test period

PVIT Purchase Options

Packet Voice Impairment Test (PVIT) is an optional feature of the Sage 93X family of test units, accessed with Option Menu # 36.

Sage 93X Model	PVIT Purchase Option
Sage 930A-L3	Option 930A-75
Sage 930i	Option 930i-75
Sage 935AT	Option 935AT-575

Packet Events and PVIT Measurements

Voice conversations over a packet switched network are potentially degraded by the four types of events the Packet Voice Impairment Test measures; voice frame losses and slips, voice clippings, and inappropriate levels of noise.

Voice Frame Loss

Lost voice frames cause bursty degradation of speech clarity. PVIT time stamps each frame loss event, and measures its duration.

Voice Frame Slips

A voice frame slip occurs when a network jitter buffer dynamically readjusts the buffer size. Buffer resizing balances the conflicting aims for less frame loss and shorter end-to-end transmission delay. A positive (+ or contracting) slip occurs when

a voice frame is destroyed. A negative (- or expansive) slip occurs when a filler frame is inserted. PVIT time stamps each voice frame slip, and measures its duration.

Voice Clippings

Packet switched networks may use voice activity detectors (VAD) for silence suppression. This function can clip the leading edge of each active voice segment, degrading speech clarity. PVIT counts voice clips, and measures their duration.

Noise Hits

PVIT measures the comfort noise level during periods of “silence.” Comfort noise above -45dBm is potentially annoying, and is considered a noise hit. PVIT counts noise hits and also calculates the average noise level over the whole test period.

PVIT Configuration

On a two wire network, perform PVIT using two Sage 93X units; one at each end. One Sage 93X sends the test signal through the packet switched network; the other 93X measures PVIT events at the other end.

On a four wire network, one Sage 93X can both send the PVIT signal and measure PVIT events on the looped back signal. Using two Sage 93X units on a four wire network allows testing in both directions simultaneously.



Two Wire Network Packet Voice Impairment Test Configuration

Performing the Packet Voice Impairment Test

Select a Trunk Type

Set up and perform the packet voice Impairment test at any two access points along the network. The Sage 93X unit (or units) initiate and answer the telephone call.

- 1** Press the Trunk Type function key to display the trunk type screen.
- 2** Select the appropriate trunk type.
- 3** Connect the phone line to the Sage TR jack.

This example shows a typical setup a Sage 93X for a two wire trunk type.

NORMAL				LOOP	TERM	CONTACT	2W 600
▼	▲	◀	▶	K1	K2	K3	K4

Make the Call

When using two Sage 93X units, you can use either one to establish the call.

- 1 With both Sage 93X units on hook, press the Dial/Ring function key on one Sage 93X.

				RPT?	DTMF	TR	
▼	▲	◀	▶	K1	K2	K3	K4

- 2 Press K3 to select DTMF.
- 3 Use the numeric keypad to enter the telephone number.
- 4 Toggle the hookswitch to the off hook position.
- 5 Press K2 (RPT?) to send the digits.
- 6 Answer the call on the other Sage 93X unit by toggling off hook.

The call is now established, and the PVIT functions can begin.

Access the PVIT Option

- 1 To access PVIT functions, press the Option Menu key and select #36.

OPTION MENU # 36 PVIT							
▼	▲	◀	▶	K1	K2	K3	K4

- 2 Press ENT or any soft (i.e., K1, K2, K3, or K4) key to display the main PVIT screen.

PVIT:	SEND	MEASURE	EXIT				
▼	▲	◀	▶	K1	K2	K3	K4

On a two wire system, use one Sage 93X unit to send the PVIT signal and the other to measure PVIT events.

The 935AT displays PVIT information using two display sequences:

- Send
- Measure

Use the send functions to transmit the PVIT signal from one end through the network to the other Sage 93X unit. The PVIT signal is sent continuously until you select another function.

Use the measure sequence on the far end Sage 93X unit to detect and measure PVIT events (voice frame losses and slips, voice clips, and noise hits). You can measure PVIT events continuously, for 24 hours, 1 hour, or 15 minutes.

Send the PVIT Signal

- 1 On one Sage 93X unit, press K1 to send the PVIT signal through the network to the other Sage 93X unit.

PVIT:		SEND	MEASURE	EXIT
▼	▲	◀	▶	
K1		K2	K3	K4

- 2 If desired, use the arrow keys or the numeric keypad to change the test signal power, or press K3 to use the default power.

SEND:		-16.0 dBm	DEFAULT	EXIT
▼	▲	◀	▶	
K1		K2	K3	K4

The default test signal level is -16.0dBm. If desired, you can change the signal level to between -40 and -3dBm.

NOTE For best results, the PVIT signal should measure at least -25dBm at the measuring Sage 93X.

Measure PVIT Events

PVIT measurements and counts display on the second Sage 93X unit. When the second Sage 93X unit is receiving the PVIT test signal, you are ready to start the test. Use the second unit to define the amount of time to measure PVIT events, to begin the test, and to view results.

Select the Test Duration

- 1 On the second Sage 93X unit, access the main PVIT screen.
- 2 Press K2 (Measure) to display the Test Length screen.

PVIT:		SEND	MEASURE	EXIT
▼	▲	◀	▶	
K1		K2	K3	K4

- 3 From the Test Length screen, press K2 to select the amount of time to conduct the test.

TEST LENGTH:		15 MINUTES	START	EXIT
▼	▲	◀	▶	
K1		K2	K3	K4

You can measure PVIT events for:

- 15 minutes
- 1 hour
- 24 hours
- Continuous (1000 hours)

Start Measuring

- 1 From the Test Length screen, press K3 to begin measuring PVIT events, and to move to the real time event counts screen.

TEST LENGTH:		15 MINUTES	START	EXIT			
▼	▲	◀	▶	K1	K2	K3	K4

This example shows the real time event counts screen 12 seconds after detecting the PVIT signal.

FL:000 FS:000 VC:000 NH:000		000:00:12					
▼	▲	◀	▶	K1	K2	K3	K4

PVIT Results

PVIT begins to display test results as soon as the measuring Sage 93X detects the PVIT signal. Results can be viewed as the test proceeds, and at the conclusion of the test period. Results are not stored and cannot be retrieved later.

If the Sage 93X is in printer remote mode, a date and time stamped report prints as each event occurs. If the 93X is in computer remote mode, the system sends a bell character (ASCII 07) to the computer. (For more information about remote control operation, see your Sage unit's technical documentation.)

There are three ways to view PVIT results during the test:

1. Counts screen
2. Individual measurement screens (6 separate screens show statistics and details)
3. Current event screen

Counts Screen

Raw event count totals display on one counts screen. Counts increment throughout the test period. At the conclusion of the test period, this screen displays the total number of each type of PVIT event that occurred.

This example shows 10 frame losses, 3 frame slips, one voice clipping, and 3 noise hits. When the test measurement period is over, the elapsed time area displays DONE.

FL: 010 FS:003 VC:001 NH:003 DONE											
▼	▲	◀	▶	K1	K2	K3	K4				

Measurement Screens

Accumulated statistics and details about each type of error display on PVIT measurement screens.

For example, this screen shows that frame loss represents 3.00% after five minutes of measuring.

%FRAME LOSS: 3.00% ELAPSED: 000:05:00											
▼	▲	◀	▶	K1	K2	K3	K4				

Most Recent PVIT Event Screen

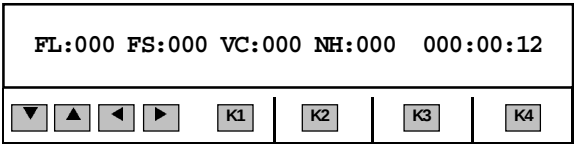
This screen displays details about the most recent PVIT event. The elapsed time indicates when the event began. The screen remains static until another event occurs.

This example shows that the most recent PVIT event was a frame loss. Its duration was 30 milliseconds, and it occurred three minutes and twenty-one seconds after the test started.

FRAME LOSS: DUR:=30ms AT: 003:21:00											
▼	▲	◀	▶	K1	K2	K3	K4				

View PVIT Results

Begin to view test results from the events count screen.



The event counts screen displays the number of each type of event as it occurs. It also displays the elapsed time. Screen abbreviations represent the following:

Screen Text	Description
FL:000	the number of voice frame loss events
FS:000	the number of voice frame slip events
VC:000	the number of voice clipping events
NH:000	the number of noise hit events
000:00:00	the elapsed measurement time in HHH:MM:SS format

When an event count exceeds 999, the screen displays +++.

The elapsed time area displays NO SIGNAL until the 93X detects the PVIT signal. The elapsed time area displays SIG LOSS if the signal is lost after measuring starts.

- 1 From the event counts screen, press K1 or the up arrow to scroll through the other results screens.
- 2 Continue to press K1 or the up arrow to return to the real time event counts screen.

View Event Details and Statistics

PVIT event statistics display in separate screens. Repeated presses of the K1 or up arrow key displays screens in the following order:

1. Percentage frame loss
2. Net effect of frame slips (in milliseconds)
3. Sum of durations of frame + slips (in milliseconds)
4. Sum of durations of frame - slips (in milliseconds)
5. Average voice clipping duration
6. Average comfort noise level

NOTE In all the event details screens below, the data shown is accumulated from the beginning of the test measurement period. As the test proceeds, the 93X automatically updates PVIT data on the screen.

Percentage of Voice Frame Loss

- 1 From the event counts screen, press K1 or the up arrow to display the %Frame Loss screen.

%FRAME LOSS: 3.00% ELAPSED: 005:02:44							
▼	▲	◀	▶	K1	K2	K3	K4

This screen shows the percentage of elapsed time that frame loss degraded the signal. In the example, three percent of the elapsed time was degraded. If no frame loss occurs the screen displays 0.00%.

Net of Slips

- 2 From the %Frame Loss screen, press K1 or the up arrow to display the Net of Slips screen.

NET OF SLIPS: +0037ms ELAPSED: 005:02:44							
▼	▲	◀	▶	K1	K2	K3	K4

This screen shows the combined effect of voice frame slips (in milliseconds) resulting from both positive and negative slips. This is calculated as the sum of all contracting slips minus the sum of all expansive slips.

A positive (+ or contracting) slip occurs when a frame is destroyed. A negative (- or expansive) slip occurs when a filler frame is inserted.

Total Voice Frame +Slips

- 3 From the Net of Slips screen, press K1 or the up arrow to display the Total +Slip screen.

TOTAL +SLIP: 26ms ELAPSED: 005:47:02							
▼	▲	◀	▶	K1	K2	K3	K4

This screen shows the total delay variation resulting from contracting (positive) frame slips. This is calculated as the sum of all contracting slips.

If the maximum exceeds the display's capability, the display shows +++++. If no contracting slips have occurred, the screen displays 0.

Total Voice Frame -Slips

- 4 From the Total +Slip screen, press K1 or the up arrow to display the Total -Slip screen.

TOTAL -SLIP: 20ms ELAPSED: 017:12:01							
▼	▲	◀	▶	K1	K2	K3	K4

This screen shows the total delay variation resulting from expansive (or negative) frame slips. This is calculated as the sum of all expansive frame slips.

If the maximum exceeds the display's capability, the display shows -----. If no contracting slips have occurred, the screen displays 0.

Average Voice Clip Duration

- 5 From the Total -Skips screen, press K1 or the up arrow to display the Average Voice Clip screen.

AVG VOICE CLIP: 10ms ELAPSED: 017:55:51							
▼	▲	◀	▶	K1	K2	K3	K4

This screen shows the average duration of voice clips during the elapsed time. If no voice clip events occur, the screen displays 0ms.

Average Comfort Noise Level

- 6 From the Average Voice Clip screen, press K1 or the up arrow to display the Average Comfort Noise Level screen.

AVG NOISE: 38dBnC ELAPSED: 017:55:51							
▼	▲	◀	▶	K1	K2	K3	K4

This screen shows the average comfort noise level during the elapsed time.

NOTE The Sage 935AT and 930A-L3 use the C-message noise filter to present the average noise level in dBnC. The Sage 930i uses the psophometric filter to present the average noise level in dBOP.

NOTE The average comfort noise level is calculated from all periods of “silence,” not by averaging noise hit events.

Most Recent PVIT Event (Current Event Screen)

- 7 From the Average Noise screen, press K1 or the up arrow to display details about the most recent PVIT event.

This screen display remains static until the next PVIT event occurs (i.e., it displays data about the most recent event until the next event occurs).

FRAME SLIP: DUR=+019 AT: 000:10:10							
▼	▲	◀	▶	K1	K2	K3	K4

This example shows that the most recent PVIT event was a contracting voice frame slip that occurred ten minutes and ten seconds after the test began.

PVIT Signal Loss

If, at any time during the test, the PVIT test signal is lost, the measuring Sage 93X unit continues to record elapsed time, but no PVIT measurements occur. When the PVIT signal is lost, the measuring Sage 93X displays the Signal Loss message in the current event screen. In the individual event details screens, the elapsed time display is replaced by SIG LOSS.

SIGNAL LOSS:		AT: 000:59:10					
▼	▲	◀	▶	K1	K2	K3	K4

Even if the PVIT signal is lost, the test concludes at the end of the defined test duration.

Lost Signal Restored

If the PVIT signal is lost and then subsequently returns, the measuring Sage93X unit resumes accumulating PVIT results. The current event screen displays the time at which the PVIT signal was again detected.

SIGNAL RESTORED:		AT: 000:59:19					
▼	▲	◀	▶	K1	K2	K3	K4

After the PVIT signal resumes, the elapsed time again displays in each of the event detail screens.

Periods with no PVIT signal are subtracted from calculations that use the total time tested in the equation (e.g., frame loss percentage).

Restarting the Test

On the measuring Sage 93X, press the CLR key at any time to restart measuring PVIT events.

Restarting returns the elapsed time to 000:00:00, and clears all PVIT events from the results screens.

Concluding the Test

When the PVIT measurement period is over, the elapsed time area on all results screens displays DONE.

At the conclusion of the test, the event counts screen displays the total number of each type of event.

Each event detail screen continues to display details about the last event, but the elapsed time area displays DONE.

NOTE If the measurement period selected is Continuous, measurements continue to increment until you select another function.

