NetVanta 7000 Series Echo Return Loss Measurement Guide

Overview

In some cases, analog lines connected to the FXO ports of the NetVanta 7000 Series Products require different impedance and gain settings than the default. Symptoms that can arise from incorrect settings are local echo (SIP phone hears its own audio returned), low audio volume on calls, and misdials in the Auto Attendant digit collection. The procedures outlined below will determine the correct impedance value for each line and allow for adjustments of the TX and RX gains to achieve the correct audio levels.

Two procedures are available to determine the correct impedance value: Automated and Manual. The Automated procedure uses a new CLI command called "test erl" on the FXO interface. The Manual procedure uses the debug command "debug voice dsp voip 0/1 channel x ecan".

See Hardware and AOS Limitations to see which procedure can be used based on your equipment.

Hardware and AOS Limitations

Based on the VoIP DSP hardware in your NetVanta 7000 Series Product, you may be able to use the Automated process. To determine the DSP hardware in your NetVanta 7000 Series Product, issue the CLI command "show version" and look for the "DSP Hardware Version".

For example:

```
NV7100#sho version
ADTRAN, Inc. OS version A1.03.00.E
…
Boot ROM version 15.01.00
…
Copyright (c) 1999-2007, ADTRAN, Inc.
Platform: NetVanta 7100, part number 1200796E1
…

NV7100 uptime is 16 days, 18 hours, 28 minutes, 12 seconds

slot 0, DSP 1
  DSP software version: G1.A2-00.04.00f
  DSP hardware version: Freescale MSC7116
  Total channels: 20
```

There are 2 "DSP Hardware" versions: **Freescale MSC7116** and **Freescale MSC7119**. The following table outlines which methods are supported by which hardware and AOS.

DSP Hardware	AOS Version Required	Procedure Supported
Freescale MSC7116	A1.03.00 or above	Manual only
Freescale MSC7119	AOS A2.02.00 or above	Automated or Manual (with A1.03.00 or above)

Automated Procedure

A new tool was added to the CLI commands of the FXO interfaces with AOS A2.02.00. This command, "test erl", automates the testing of an FXO interface with different impedance values. It can also be configured to "auto-set" the best measured impedance setting for the interface.

Before you begin
- The analog line from the service provider must be connected to the FXO interface.
- The FXO interface must be connected to a voice Trunk Account in order to make the tool available for use.
- The analog line must be idle (no calls in progress).

Options

You can run the automated ERL tool in the following ways:
- Run using only the current impedance setting
- Run using all available impedance settings
- Run using all available impedance settings and automatically configuring the best impedance match.
- Display the ERL test results
- Clear the ERL test results

CLI Test Commands

[no] test erl current
[no] test erl all [auto-set]
test erl display-results
test erl clear-results

Step by Step

1. Select the FXO interface to be tested (for example interface fxo 1/1).
2. Access the CLI in enabled configuration mode and select the FXO interface by entering "interface fxo 1/1" at the prompt.
3. Choose which option you want to use. For this example, we'll use "test erl all auto-set".
4. To watch the results live, you can use the debug command listed further down in this document. Or to get a periodic status, in a separate CLI session, you can enter "test erl display-results" to see the current snapshot of the status from testing. See below for example of this.

```
NV7100(config-fxo 0/1)#test erl display-results

Port        Impedance          Status              Measured ERL
-------------------------------------------------------------
 fxo 0/1    600c                                     10 dB
 fxo 0/1    900r                                     8 dB
 fxo 0/1    900c                                     9 dB
 fxo 0/1      z1                                     13 dB
 fxo 0/1      z2                                     11 dB
 fxo 0/1      z3                                     14 dB
 fxo 0/1      z4                                     12dB
 fxo 0/1      z5               test calling
```

Common "low" ERL values are between 5 and 8 dB. Acceptable ERL values begin around 12dB. Remember, the higher the ERL you can get, the more gain adjustment can be made without introducing echo.

5. Once the testing is complete, if the "auto-set" option was used, the system will apply the best match impedance value.
6. During the test, the tool will set the FXO TX and RX gain levels to "0dB" to make the proper measurements and then will return them to the configured values when the test is complete. Additional adjustments may be required to these values after the best impedance value has been chosen by the tool. This may take some adjustment and audio level observation.

The commonly recommended configuration is to use an "rx-gain" of 0 dB and a "tx-gain" of +6 dB. The "rx-gain" value adjusts the level being transmitted from the FXO to the line. The "tx-gain" value adjusts the level being transmitted from the FXO to the DSP within the NetVanta 7000 Series Product.

7. Finally, save the configuration on the system and download a copy of this configuration as a backup.

CLI Show Commands

```
show interface fxo 0/1
fxo 0/1 is UP
  Two-wire Status:     Onhook
  Test Status:         INACTIVE
    No Tests
  Impedance:           600 ohms +2.16uF
  Transmit Gain:       +6.0dB
  Receive Gain:        +0.0dB
  Measured ERL:        14 dB
```

Note that the displayed **Measured ERL** *corresponds to the result table entry for the configured impedance. If the impedance setting is changed, the displayed* **Measured ERL** *changes accordingly. If there is no corresponding result,* **Measured ERL not available** *is displayed instead.*

CLI Debug Commands

You can monitor the progress of the ERL testing by using the following debug command.

debug voice erltool info

Here is an example output from this command:

```
NV7100(config-if)#test erl all auto-set
12:24:50 ERL.INFO  fxo 0/1 erl measurement started, using impedance 600c
12:24:55 ERL.INFO  fxo 0/1 impedance 600c - measured erl 14 dB
12:24:55 ERL.INFO  fxo 0/1 erl measurement started, using impedance 900r
12:25:00 ERL.INFO  fxo 0/1 impedance 900r - measured erl 25 dB
12:25:00 ERL.INFO  fxo 0/1 erl measurement started, using impedance 900c
12:25:05 ERL.INFO  fxo 0/1 impedance 900c - measured erl 20 dB
12:25:05 ERL.INFO  fxo 0/1 erl measurement started, using impedance z1
12:25:11 ERL.INFO  fxo 0/1 impedance z1 - measured erl 10 dB
12:25:11 ERL.INFO  fxo 0/1 erl measurement started, using impedance z2
12:25:16 ERL.INFO  fxo 0/1 impedance z2 - measured erl 10 dB
12:25:16 ERL.INFO  fxo 0/1 erl measurement started, using impedance z3
12:25:21 ERL.INFO  fxo 0/1 impedance z3 - measured erl 10 dB
12:25:21 ERL.INFO  fxo 0/1 erl measurement started, using impedance z4
12:25:27 ERL.INFO  fxo 0/1 impedance z4 - measured erl 8 dB
```

```
12:25:27 ERL.INFO  fxo 0/1 erl measurement started, using impedance z5
12:25:32 ERL.INFO  fxo 0/1 impedance z5 - measured erl 9 dB
12:25:32 ERL.INFO  fxo 0/1 erl measurement started, using impedance z6
12:25:37 ERL.INFO  fxo 0/1 impedance z6 - measured erl 10 dB
12:25:37 ERL.INFO  fxo 0/1 erl measurement started, using impedance z7
12:25:43 ERL.INFO  fxo 0/1 impedance z7 - measured erl 12 dB
12:25:43 ERL.INFO  fxo 0/1 erl measurement started, using impedance 600r
12:25:48 ERL.INFO  fxo 0/1 impedance 600r - measured erl 15 dB
12:25:48 ERL.INFO  fxo 0/1 Best result is 25 dB using impedance setting 900r

2008.08.21 12:25:48 ERL.INFO  fxo 0/1 Configuration has been automatically updated
 Appropriate commands must be issued to preserve configuration

2008.08.21 12:25:48 ERL.INFO  fxo 0/1 erl test finished
```

Errors and Warnings

The following error is a result of attempting to measure ERL when a measurement sequence is already active.

> % could not run erl test

During test execution, the operator is warned when a test sequence terminates abnormally. Reasons include

- Not being able to seize the line
- Line disconnects during test
- DSP timeout (for example, when the DSP Hardware version does not support the Automated method
- The test runs for more than 20 seconds per impedance value. For example, 80 seconds with 4 impedance settings.

Manual Procedure

A debug command has been added to allow for the measurement of Echo Return Loss (ERL), which is important in determining the proper impedance value needed for an analog line. Here is the syntax for the command:

debug voice dsp voip 0/1 channel x ecan

Using the Debug Command

This debug command is designed to allow for testing of different impedance settings and viewing the Echo Return Loss (ERL) value given by each setting. The goal is to get the highest ERL possible.

The "tx-gain" and "rx-gain" values on the FXO interface being tested affect the overall ERL. Make sure they are both set to "0" during the debug process.

1. Place or receive a call on an IP phone through the analog trunk.

2. Verify which Trunk Account/FXO interface you are using for the call. The "debug interface fxo" and "debug voice summary" commands can show which Trunk Account/FXO is being used.

3. Verify there is 2-way audio.

4. Use the command "show media-gateway summary active" to determine which RTP channel is being used.

Remember that if the output of this command shows you using channel 1, then use channel 0 in the next step. Note what channel this is for disabling the debug in Step 11.

5. Enable the ERL Debug with the following command, where x is the channel as described above:
   a. "debug voice dsp voip 0/1 channel x ecan"

Note that the caller on the far end will hear white noise generated while the debug is active.

6. The debug will output the following lines every 5 seconds (date & time removed for spacing).

VOIPGATEWAY.VOIP 0/1 1 ECAN: **Rin: -7 dBm0**, **Sin: -33 dBm0**, Bkgd: -62 dBm0, ERLE: 11 dB, **ERL: 24 dB**
VOIPGATEWAY.VOIP 0/1 1 ECAN: ver: 000A060D, ctrl: 000040D3, max delay: < 15, cur delay: < 15, use: 2, fill: 1

7. Wait for at least two instances of the debug output to measure. Note the **ERL** value given and compare to the difference between **Rin** and **Sin**. Occasionally the **ERL** calculation can be slightly different, but the difference between **Rin** and **Sin** will be correct.

8. Enter the configuration mode for the active FXO interface and choose a new impedance value from the ones listed below. Note that z5, z6, and z7 are more ideal for long loop lengths.
   a. 600c (default)
   b. 600r
   c. 900c
   d. 900r
   e. z1 – Rs 220 ohms, Rp 820 ohms, Cp 115nF
   f. z2 – Rs 270 ohms, Rp 750 ohms, Cp 150nF
   g. z3 – Rs 270 ohms, Rp 750 ohms, Cp 150nF, while Zin is 600r
   h. z4 – Rs 320 ohms, Rp 1050 ohms, Cp 230nF
   i. z5 – Rs 350 ohms, Rp 1000 ohms, Cp 210nF, while Zin is 600r
   j. z6 – Rs 370 ohms, Rp 620 ohms, Cp 310nF
   k. z7 – Rp 800 ohms, Rs 100 ohms, Cs 50nF
9. Note the **ERL** value with each configured impedance value.

10. Choose the impedance value that gives the highest **ERL** value.

Common "low" ERL values are between 5 and 8 dB. Acceptable ERL values begin around 12dB. Remember, the higher the ERL you can get, the more gain adjustment can be made without introducing echo.

11. Once you have the best impedance setting, re-adjust the "tx-gain" and "rx-gain" while confirming that the ERL stays within the acceptable range.

A common configuration is to use an "rx-gain" of 0 dB and a "tx-gain" of +6 dB. The "rx-gain" value adjusts the level being transmitted from the FXO to the line. The "tx-gain" value adjusts the level being transmitted from the FXO to the DSP within the NetVanta 7000 Series Product.

12. To disable the debug:
   a. "undebug all" will **NOT** work

       b. Use "no debug voice dsp voip 0/1 channel x"

13. Repeat the procedure for all FXO ports in use. (Each port can have a different measured ERL value, so all must be tested for accuracy).

14. Save the configuration.

15. Test the trunk again to confirm that no echo is heard, volume levels are acceptable for both ends of the call, and if an Auto Attendant is being used that the digit presses are interpreted correctly.