Echo Cancellation Configuration for Communication Manager T1 / E1 Interfaces
Includes firmware V15 additions

ABSTRACT

The most recent DS1/E1 Communication Manager interface boards (TN464GP, TN2464BP, mm710) provide built-in echo cancellation capabilities. These notes describe how to configure this capability and describe the differences between the Echo Cancellation Modes.

Application Note

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1. Introduction

Starting with Avaya Communication Manager Release 9, DS1/E1 interfaces, TN464GP, TN2464GP, and mm710 have provided powerful built-in echo cancellation capabilities. This note describes how to administer this capability and discusses the differences between the echo cancellation modes.

1.1. References

555-233-506 - Administrator’s Guide for Avaya Communication Manager
555-233-143 - Maintenance for the Avaya S8700 Media Server with the SCC1 or MCC1 Media Gateway
555-233-504 – Administration for Network Connectivity for Avaya Communication Manager

2. General

Echo cancellation on the T1/E1 interfaces is a software right-to-use feature, so the system license must be set to allow the feature as well as allowing the desired number of interfaces to be activated.

In general the process is:

- Enable the feature system wide on the System Parameters Customer Options screen. Set “DS1 echo cancellation” to y.

- Verify the number of DS1 interfaces allowed by the license is adequate. Use the “display system-parameters customer-options” command and review the “Maximum Number of DS1 Boards with Echo Cancellation” field.

- Turn on echo cancellation on the trunk group form. Set “DS1 echo cancellation” to y.

- Turn on echo cancellation on the DS1 board form. Set “Echo cancellation” to y, set the EC Direction and EC Configuration fields as described below.
3. Direction – inward or outward

The DS1 Circuit Pack form allows the echo cancellation function to be specified as inward, meaning to cancel echo energy coming into the interface across the T1/E1 circuit, or outward, meaning cancel echo energy coming to the T1/E1 card from the switch and going out toward the T1/E1 circuit. Generally inward is selected when connected to a local exchange carrier (LEC). Outward may be used more commonly when connected to a private network (tie trunk). All circuits on a T1/E1 interface are set to the same direction.

4. The EC Configurations

In addition to the inward / outward settings, each T1/E1 circuit pack must be configured to choose an echo cancellation configuration. Prior to V15 firmware there were four configurations to choose from, starting with FW V15 there are nine configurations to choose from. These configurations are combinations of many tunable low-level echo cancellation parameters designed to deal with returned echo signals with highly variable properties. These values represent many years of experience with a wide variety of networks and on extensive laboratory subjective and objective tests. Functions such as adaption and digital adaptive filtering involve learning the characteristics of the voice signal and echo to determine how to do the cancellation. There is an initial connection setup adaption (fast convergence) component as well as a continual adaption component (slow convergence).

The following configurations operate over a variety of situations to provide the best possible speech quality.

4.1. EC Configuration 1 – Highly Aggressive Echo Control

This configuration can control very strong echo from a distant party. It (and EC 4) provide the most rapid convergence in detecting and correcting echo at the beginning of a call. The initial echo fades faster than the other settings (generally in a small fraction of a second) regardless of the loudness of the talkers voice. **Configurations one and four are the same except for loss**, EC 4 has 0 dB of loss and EC 1 has 6 dB of loss,
which makes EC 1 a good choice for consistently high network signal levels. EC 1 can cause low-volume complaints and/or complaints of clipped speech utterances, particularly during doubletalk (both parties speaking simultaneously). Because EC 1 strongly relies on echo suppression to help control echo, “pumping” of the distant party’s background noise may occur and lead to complaints. Prior to Communication Manager 2.0 configuration one was the default configuration.

EC 1 Loss Direction
The 6dB of loss in EC configuration one is in one direction only and depends on the setting of the “EC direction field” on the ds1 board form (See section three). If the direction is set to inward, then the 6dB of loss is inserted in the path out from the board towards the T1/E1 circuit. Conversely, if the setting is outward, then the 6dB of loss is inserted into the path from the T1/E1 circuit towards the TDM bus.

4.2. EC Configuration 2 Aggressive, Stable Echo Control
This configuration is nearly identical to EC 1 but 1) it does not inject an additional 6 dB of signal loss and 2) convergence of the echo canceller is slower, but more stable, than that provided by EC 1. If EC 1 is found to diverge during doubletalk conditions – noticeable by the sudden onset of audible echo – EC 2 should be used in place of EC 1. Because the echo canceller will converge somewhat slower, some initial echo may be noticeable at the start of a call. EC 2 can cause complaints of clipped speech utterances, particularly during doubletalk (both parties speaking simultaneously). Because EC 2 strongly relies on echo suppression to help control echo, “pumping” of the distant party’s background noise may occur and lead to complaints.

4.3. EC Configuration 3 – Aggressive, Very Stable Echo Control
This configuration is nearly identical to EC 2 but is even more stable. Because the echo canceller will converge somewhat slower, some initial echo may be noticeable at the start of a call. EC 3 can cause complaints of clipped speech utterances, particularly during doubletalk (both parties speaking simultaneously). Because EC 3 strongly relies on echo suppression to help control echo, “pumping” of the distant party’s background noise may occur and lead to complaints.

4.4. EC Configuration 4 – Highly Aggressive Echo Control
EC 4 is identical to EC 1 but does not provide the 6 dB loss option as described above for EC 1. All other comments for EC 1 apply to EC 4. EC 4 can cause complaints of clipped speech utterances, particularly during doubletalk (both parties speaking simultaneously). Because EC 4 strongly relies on echo suppression to help control echo, “pumping” of the distant party’s background noise may occur and lead to complaints.

4.5. EC Configuration 5 – Very Moderate, Very Stable Echo Control
EC 5 departs significantly from configurations EC 1 through EC 4. The echo canceller is slower to converge and is very stable once it converges. Some initial echo may be heard at the beginning of a call. EC 5 will not, in general, lead to complaints of clipped speech utterances or pumping of the distant party’s background noise.
4.6. EC Configuration 6 - Highly Aggressive Echo Control

EC 6 is identical to EC 4, but reliance on the echo suppressor to control echo is about one-half that of EC 4. As a result, EC 6 will not clip speech as much as EC 4, but may cause somewhat more audible echo, particularly at the start of a call. Some pumping of the distant party’s background noise may be perceptible.

4.7. EC Configuration 7 -- Extremely Moderate & Stable Echo Control

EC 7 provides very stable and transparent control of weak to low-level echoes. For connections having audible echo at the start of a call, the residual echo may linger for several seconds as the echo canceller converges.

4.8. EC Configuration 8 -- Aggressive, Very Transparent Echo Control 1

EC setting 8 provides aggressive control of echo at the start of a call and more moderate control during the call. Unlike all prior settings, EC 8 uses “comfort noise” injection to match the actual noise level of the distant party’s speech signal. The effect is one of echo canceller “transparency,” in which complaints of clipped speech or noise pumping should be few to none. To many people, EC 8 and EC 9 will be indistinguishable.

4.9. EC Configuration 9 -- Aggressive, Transparent Echo Control 2

EC 9 is nearly identical to EC 8 but provides somewhat more residual echo control at a slight expense of transparency. To many people, EC 8 and EC 9 will be indistinguishable.

Tips:

A helpful capability of the T1/E1 echo cancellation feature is that you can change the EC Configuration setting on the fly and it takes effect immediately. You don't have to busyout / release or reset the board. You can leave a call up, change these parameters and immediately hear the effect of the change.

Enabling or disabling the echo cancellation function via the trunk group form of the DS1 board form, in contrast, can take up to 15 minutes if you wait for periodic maintenance to update the port level settings. Alternatively, the port level settings can be immediately updated by a busyout and release of the DS1 board. This is service disrupting for calls active on the T1/E1 circuit.

EC Configurations 10 through 15 can be selected, but at this time they use configuration one.

5. Exceptions

Recent software displays a warning message that the EC configurations other than 2, 3, and 4 will insert 6dB of loss. This is an error, the loss is only inserted for EC configuration one and configurations which aren’t implemented (which actually select configuration one). Prior to FW V15 5-15 were not implemented and starting with FW V15 10-15 are not implemented.
Tone disablers - Echo cancellation is for voice only, these echo cancellors detect modem tone (2100 HZ with or without phase reversals) in either direction and disable the cancellation function for the duration of the call.

Prior to mm710 FW V8 there was a mismatch between how the TN464GP and the mm710 interfaces implement the EC(1-4) settings. MM710 EC=1 was the same as TN464GP EC=4 and mm710 EC=4 was the same as TN464GP EC=1. For settings 2 and 3 the TN464 and mm710 behave the same. The mm710 board, starting with FW V8 changed the EC=1 and 4 to match the TN464GP. This was released in May of 2003.

This echo cancellation capability operates with a cancellation tail length of 96 milliseconds. Echoes of longer duration should be resolved externally.

6. Conclusions

Echo cancellation on the Communication Manager T1/E1 interfaces is a software-right-to-use feature and therefore must be enabled in the system license. Administering it is a simple process involving selecting the interfaces, the direction, as dictated by the source of the echo, and a configuration number. The EC configuration typically is configuration four or eight but experimentation may show other configurations to be preferable.