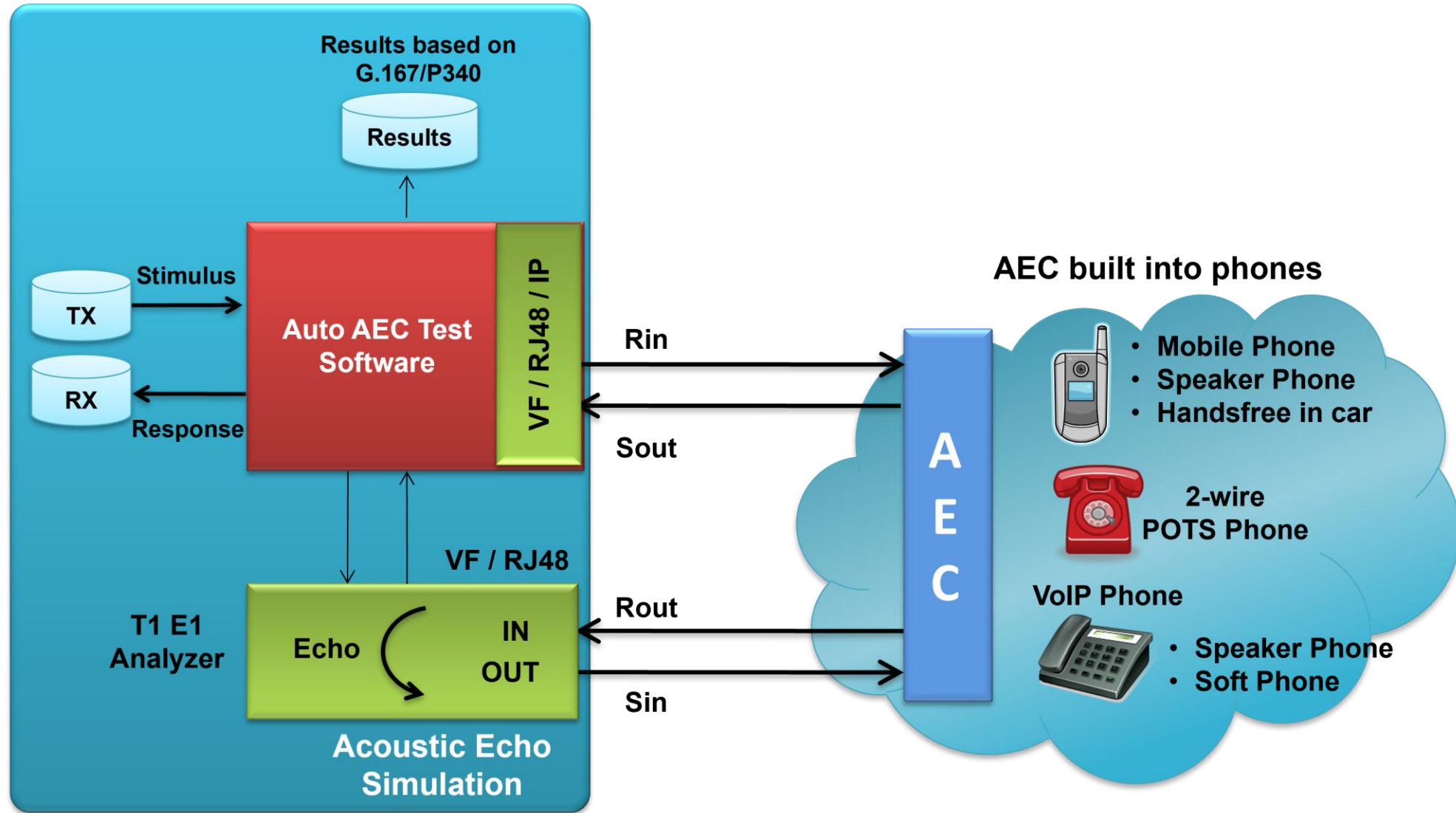

Acoustic Echo Cancellation Compliance Test Software



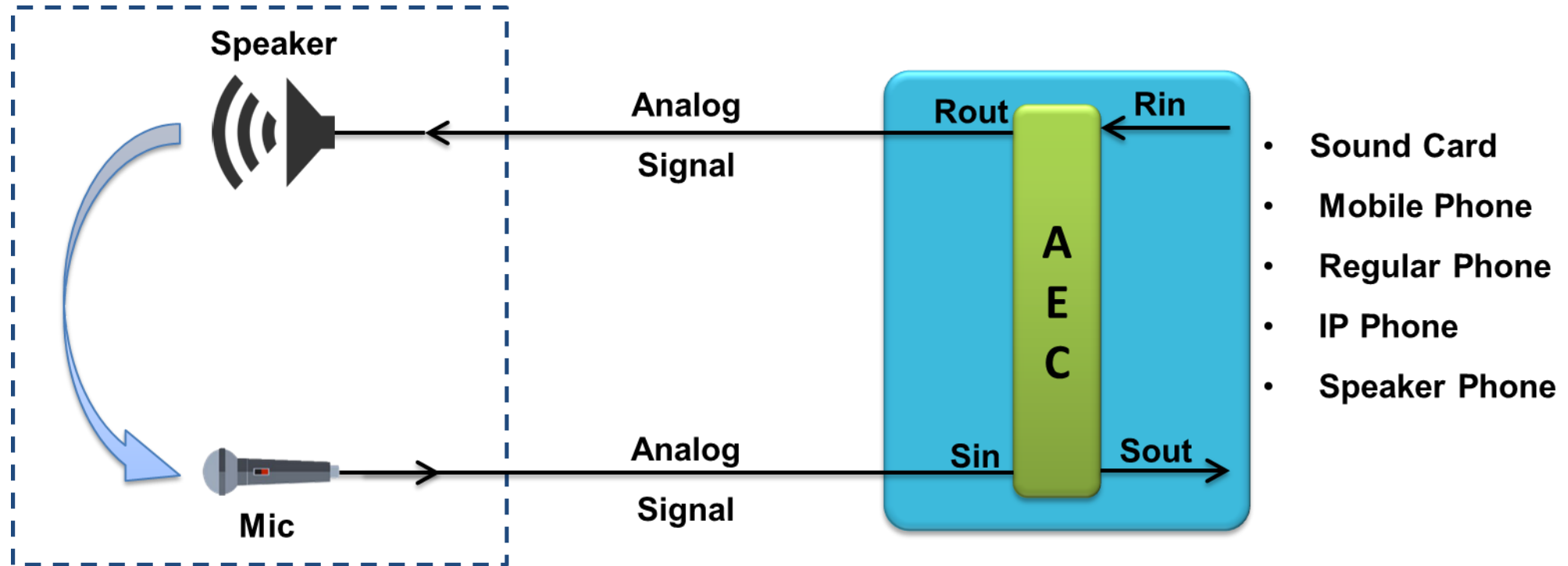
818 West Diamond Avenue - Third Floor, Gaithersburg, MD 20878
Phone: (301) 670-4784 Fax: (301) 670-9187 Email: info@gl.com
Website: <https://www.gl.com>

Overview



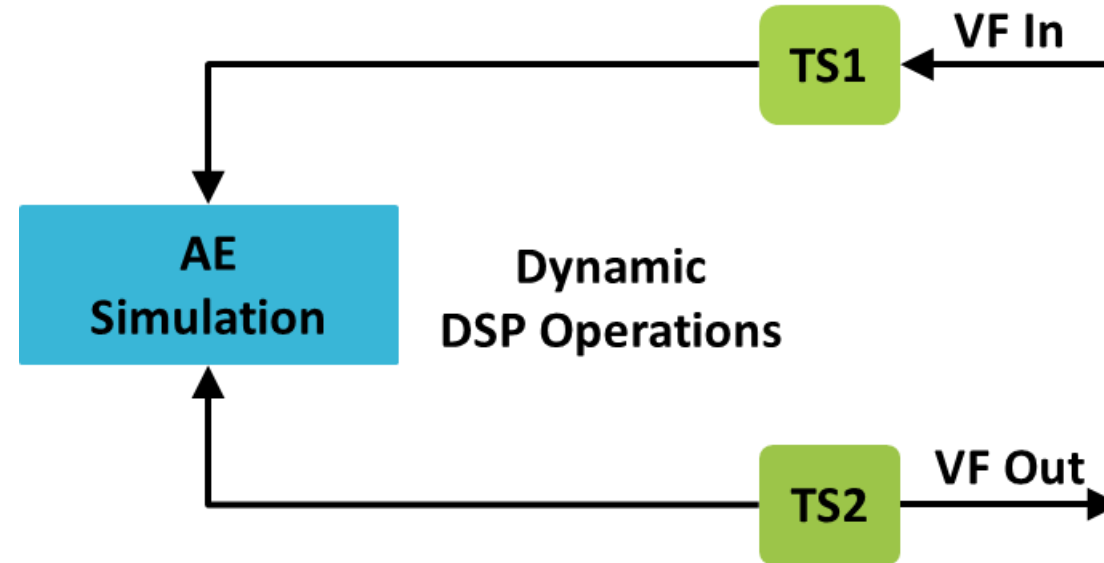
Basic Concept

- During the transmission and receiving of Rin, Rout, Sin and Sout, the AEC is manually or automatically controlled
- Rin or Sin files (stimulus and echo) are generated as per the user requirements
- Sout and Rout files are captured and automatically assessed
- AEC conformance to the ITU-T Specifications, G.167 (03/1993) and P.340 (05/2000)



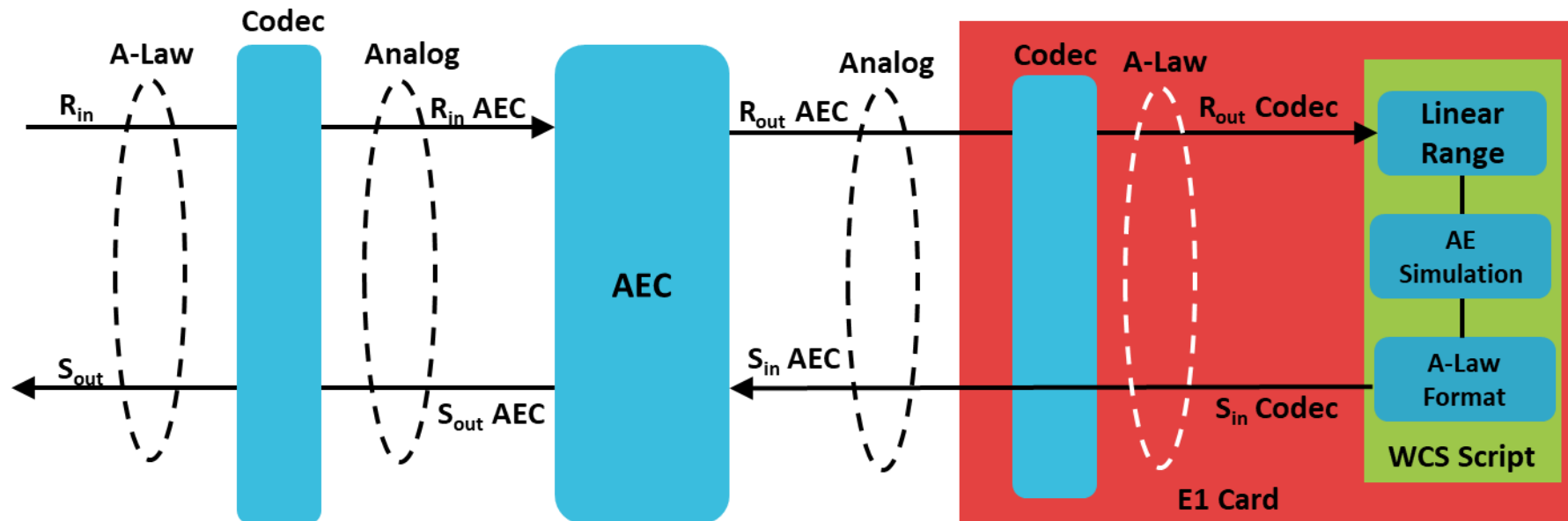
Acoustic Echo Simulation using Dual T1 E1 Card

- Automated Acoustic Echo Canceller (AEC) Test software uses WCS (Windows Client Server) software and Dual T1 E1 hardware platforms to transmit/receive files and to simulate the acoustic echoes in real time, which is used for TDM and VoIP applications



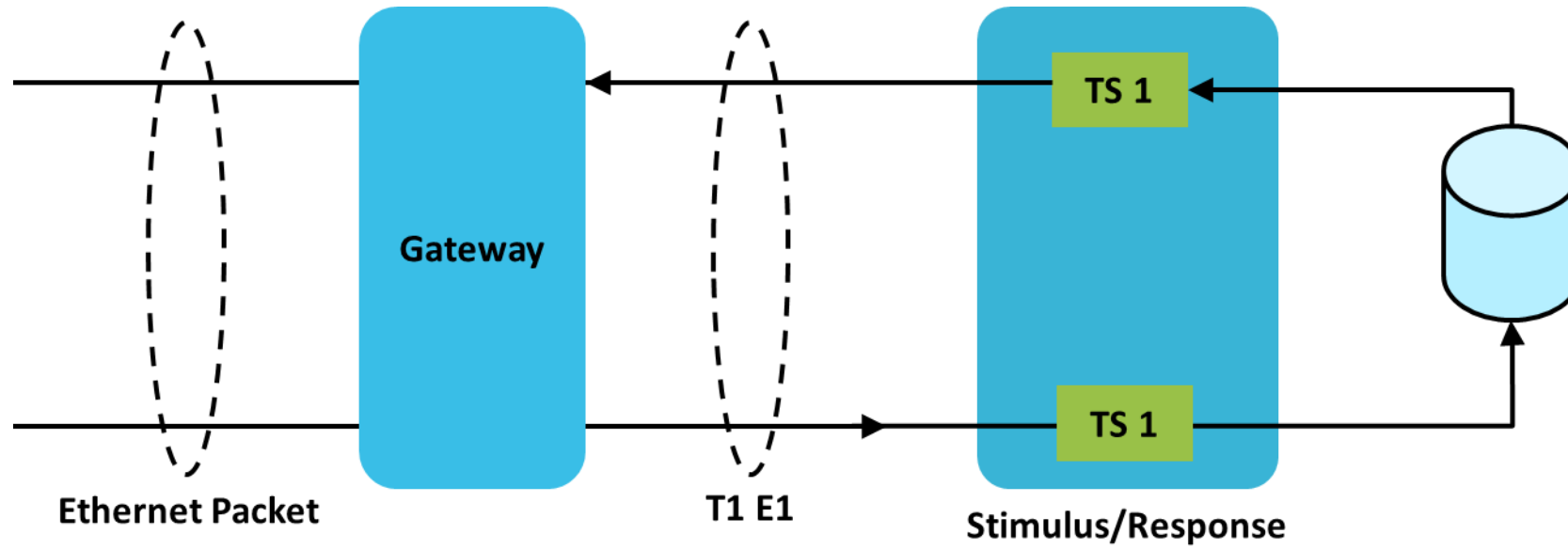
Acoustic Echo Cancellation and Overall Path

- Measurement Limitation in our Setup
- As depicted in the E1 card section , the analog signal is converted to Alaw format by the codec, which is again converted to linear range in WCS script. Acoustic echo is simulated in linear data format
- Echo simulated data is converted to Alaw format, which is again converted to analog signal by the codec and transmitted across the path
- 16-bit A/D or D/A has a theoretical SNR of 96 db (6 dB x 16 bits). Alaw has SNR of about 39 dB for signals between 0 dBm and -30 dBm using Alaw to simulate echo decreases the efficiency of the AEC because of the higher quantization noise. This is reflected as higher noise and less cancellation at Sout. Hence, accuracy of TCLwst measurement is decreased by around 7 to 10db



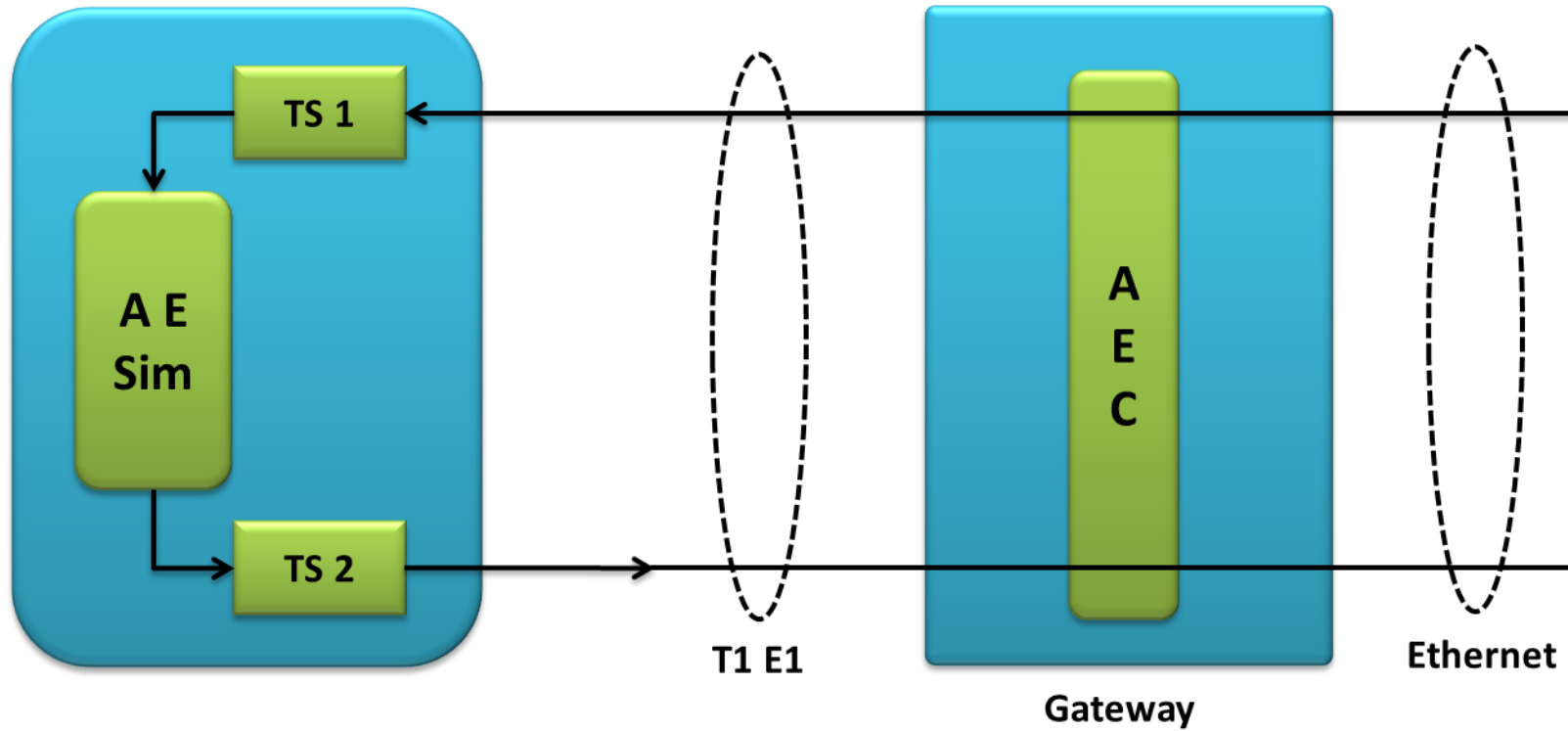
AEC and Signal Generation/Reception

Typical Connections

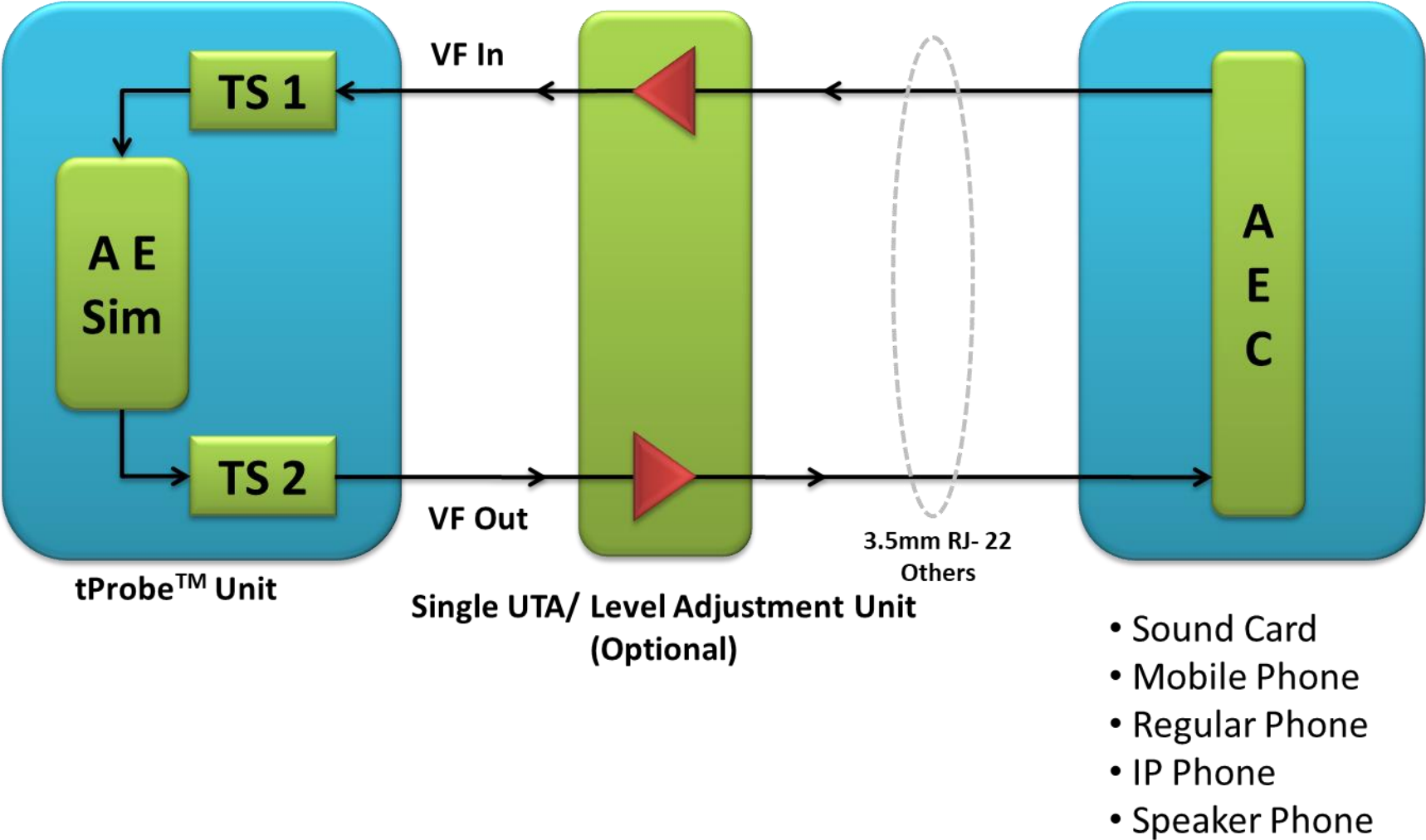


Acoustic Echo Canceller/Simulator for Digital & Packet Domains

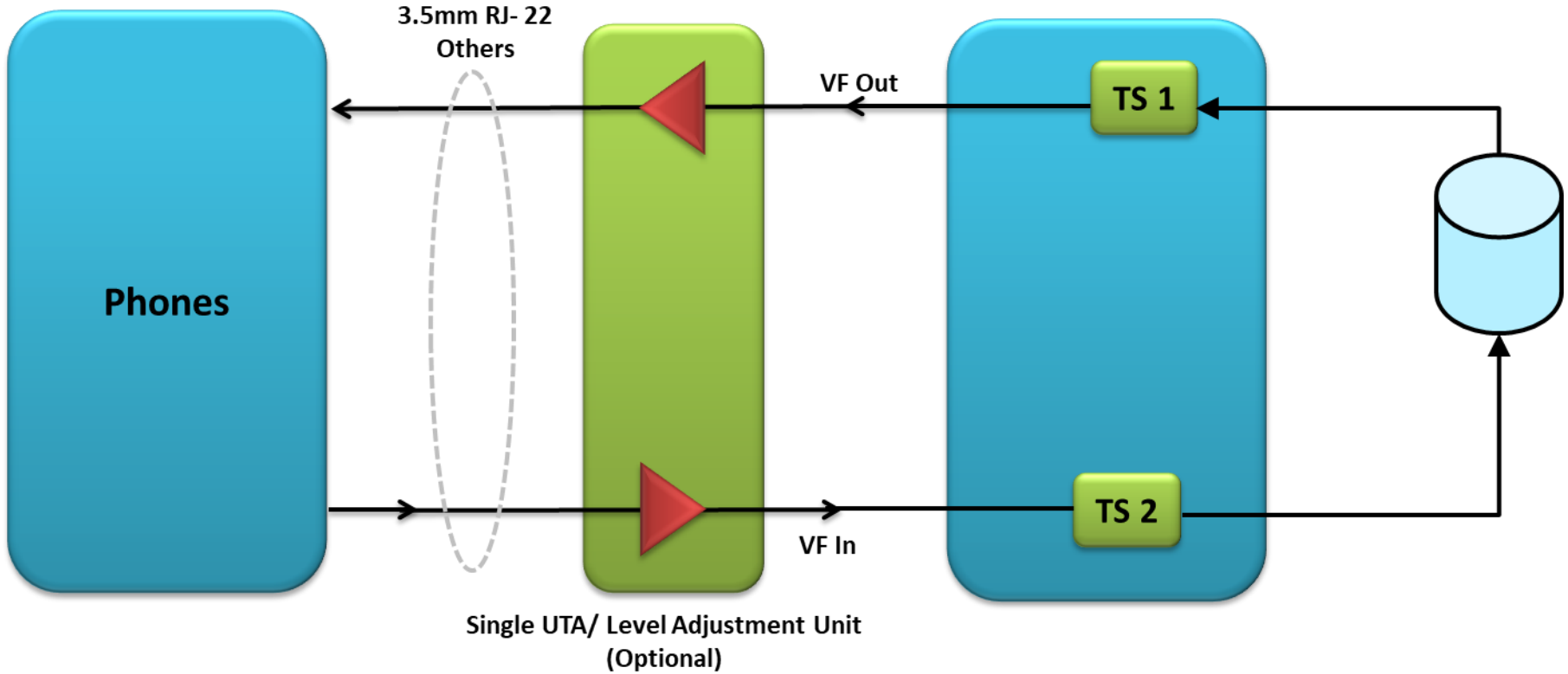
Typical Connections



Level Adjustment Unit between AEC and Acoustic Echo Simulator



Level Adjustment Unit at the Stimulus / Response End



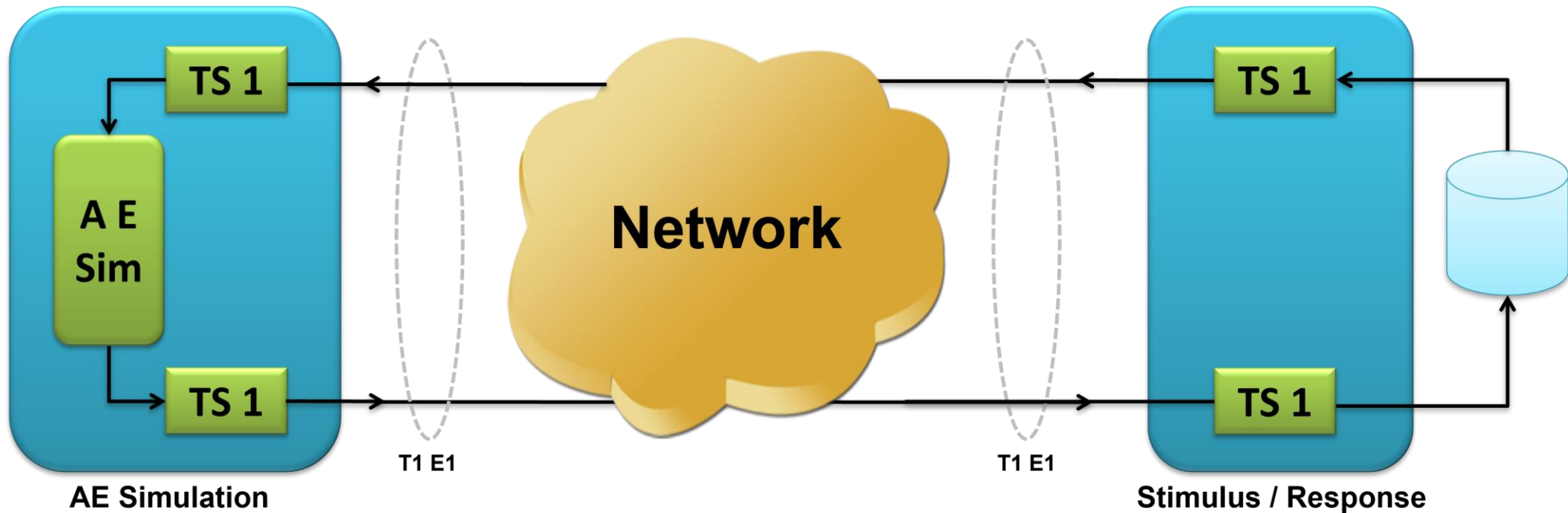
End to End Applications for Mobile, TDM, & VoIP

- Case 1: Simulation Digital – Stimulus Digital (TDM to TDM)
- Case 2: Simulation Analog – Stimulus Analog (TDM to TDM - Mobile Applications)
- Case 3: Simulation Digital – Stimulus RTP (VoIP to TDM with Gateway)
- Case 4: Simulation Analog – Stimulus RTP (VoIP to TDM with IP Phone)

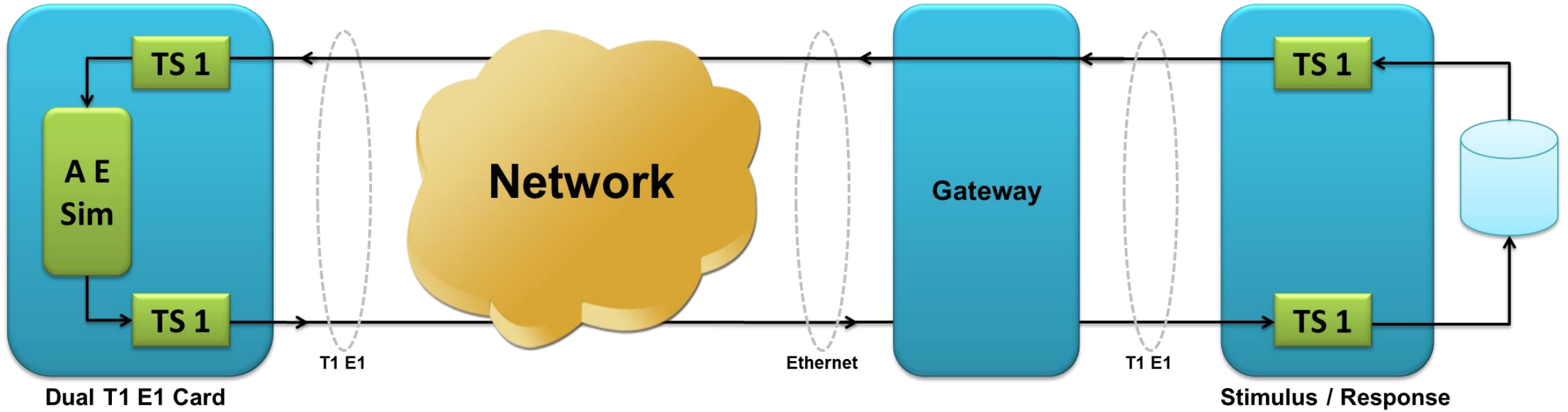
Simulation Digital - TDM to TDM

Case 1

- In this scenario, the AEC is assumed to be in the network. Acoustic echoes are simulated within the GL's T1 E1 platforms digitally. The generation of the stimulus signal and the capture of the response signal is also performed by GL's T1 E1 platforms

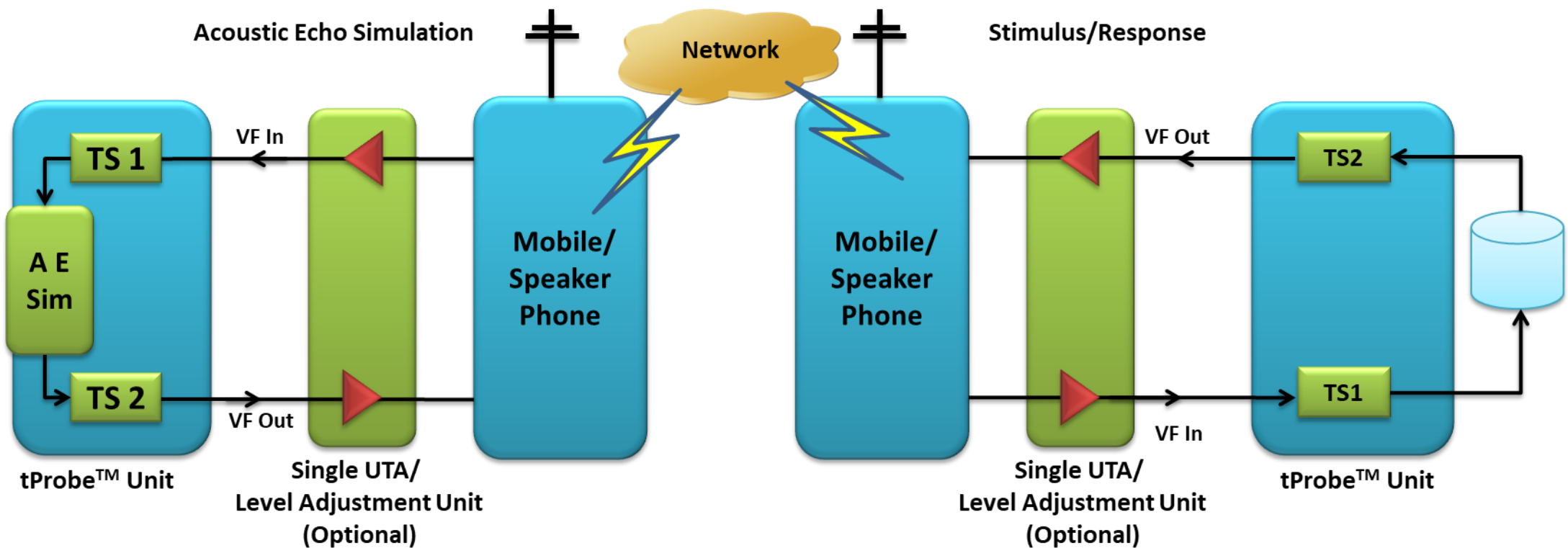


TDM to TDM with Gateway



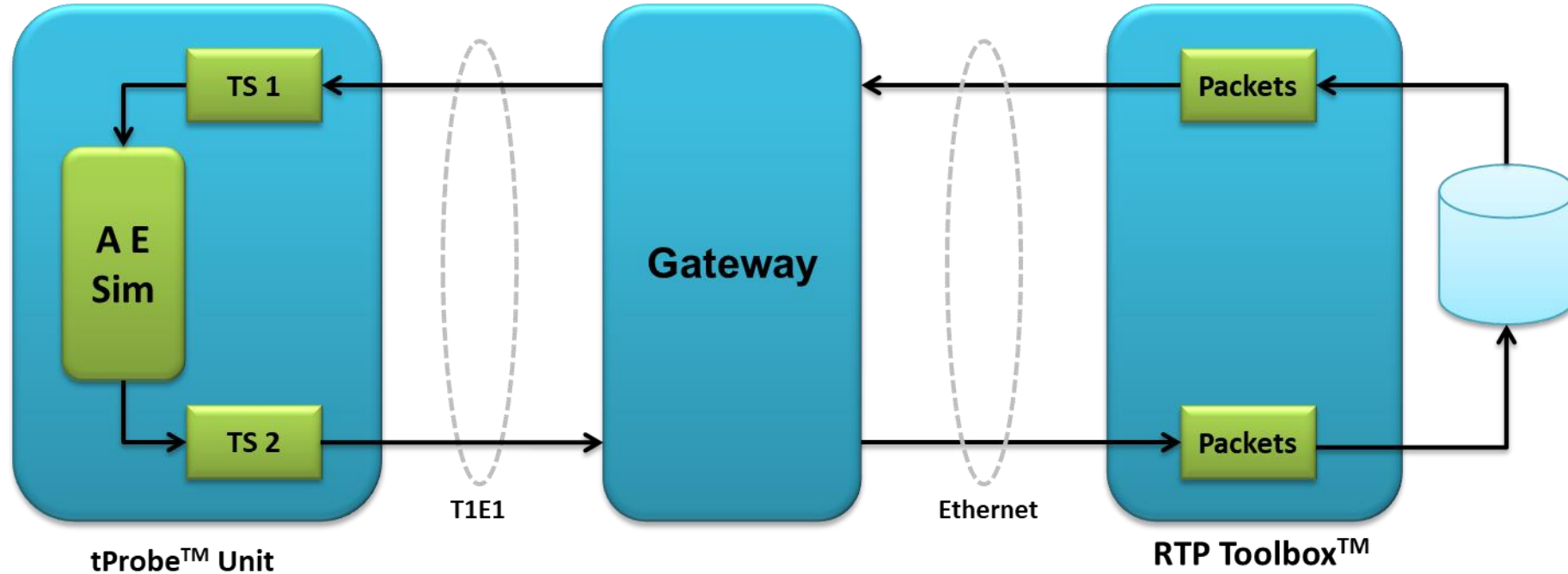
Simulation Analog – TDM to TDM (Mobile Applications)

- In this scenario, the AEC is assumed to be in a mobile phone and accessed thru an analog interface. Again, GL's T1 E1 platforms with analog interfaces are used to convert analog signals to digital and subsequent processing is performed digitally. Level adjustment accessories are used between mobile phone and the Dual T1 E1 (tProbe™ unit) to accommodate various signal levels and impedances

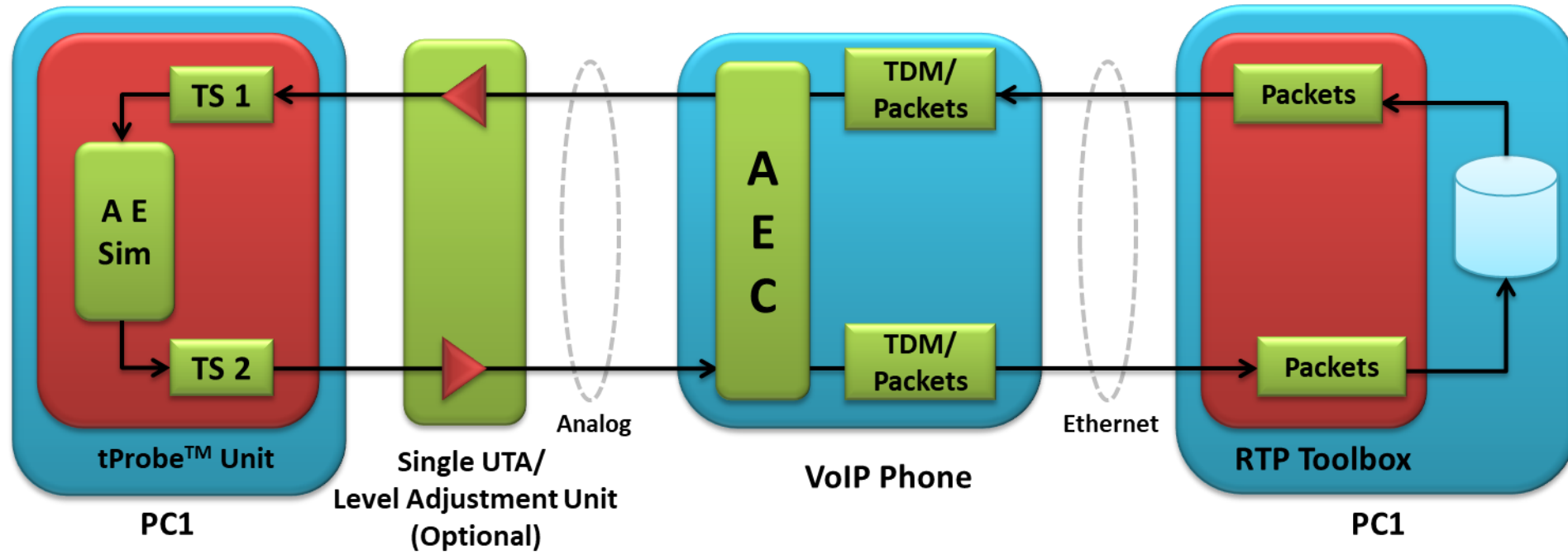


VoIP to TDM with Gateway

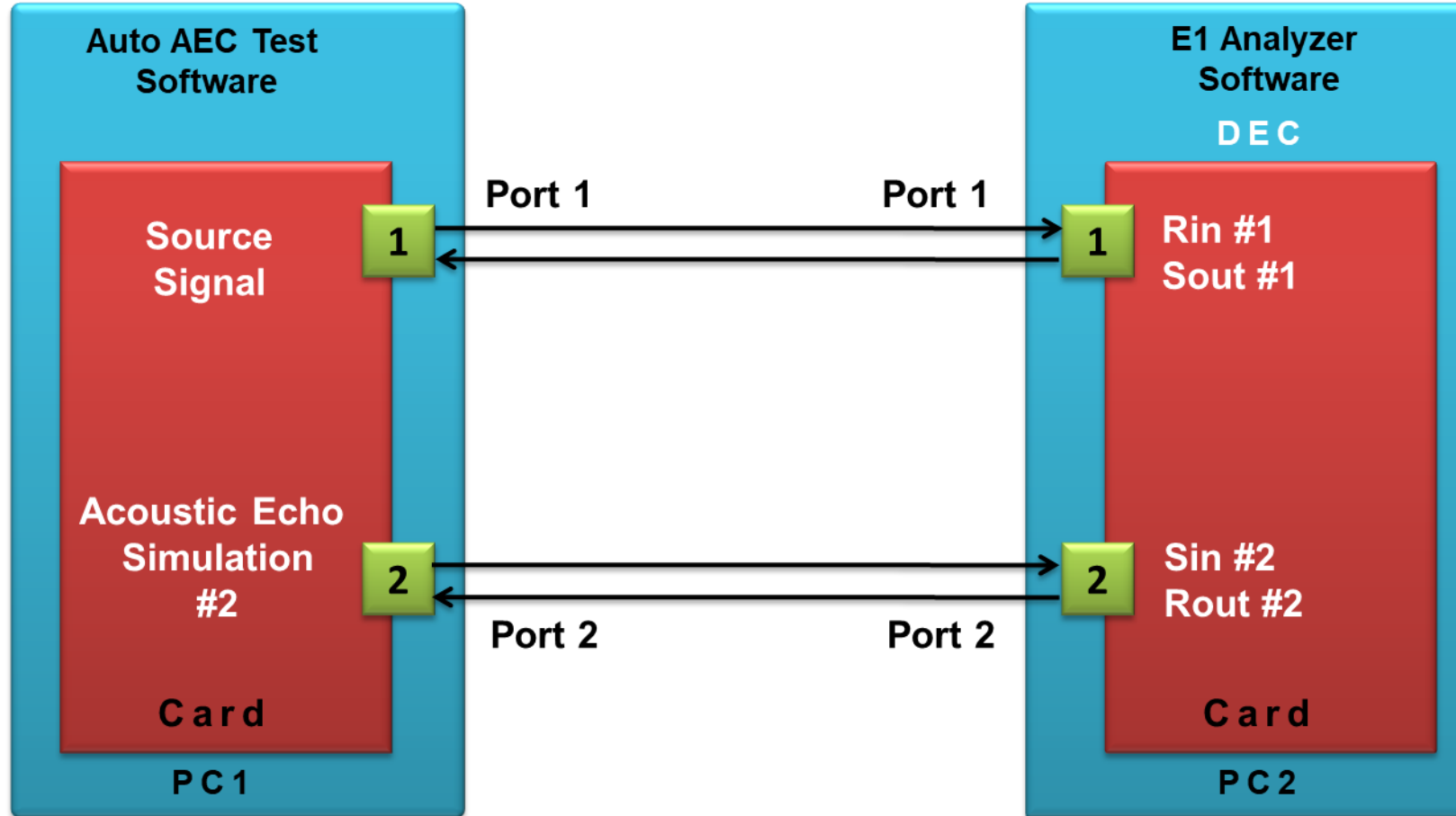
- In this scenario, the stimulus and response signals are generated by GL's RTP Toolbox™ through an Ethernet interface and simulation is performed digitally by GL's T1 E1 platforms, whether accessed through analog or digital interfaces



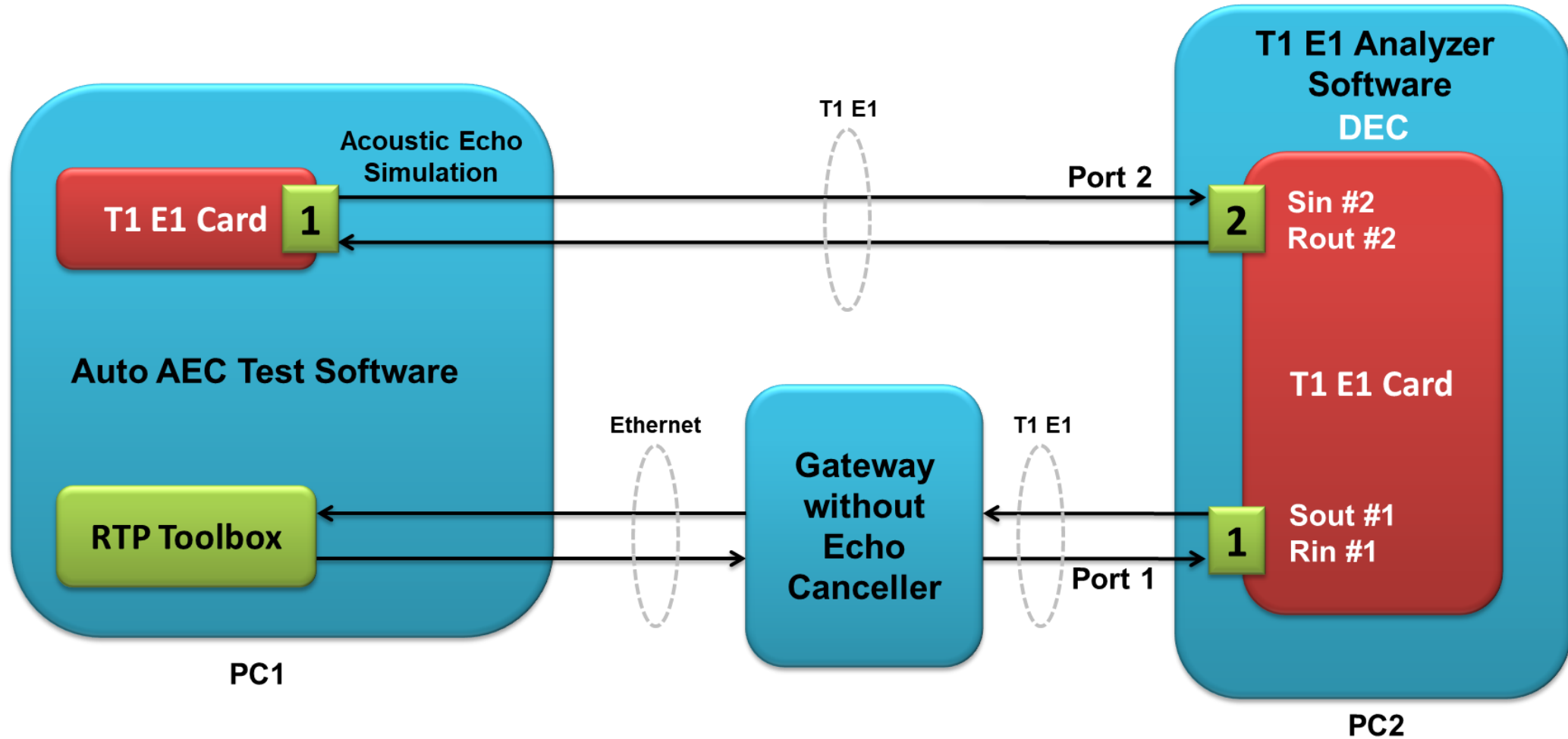
VoIP to TDM with IP Phone



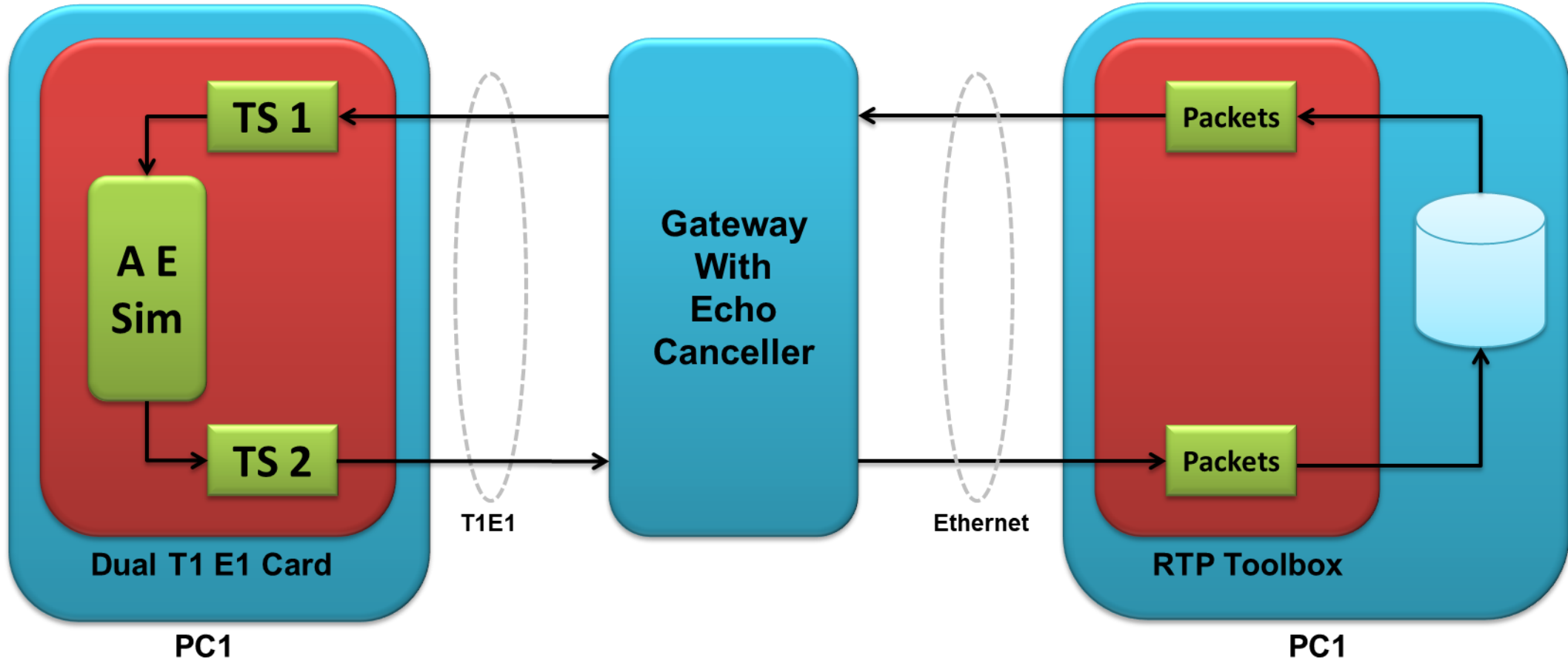
TDM to TDM Acoustic Echo Simulation using DEC



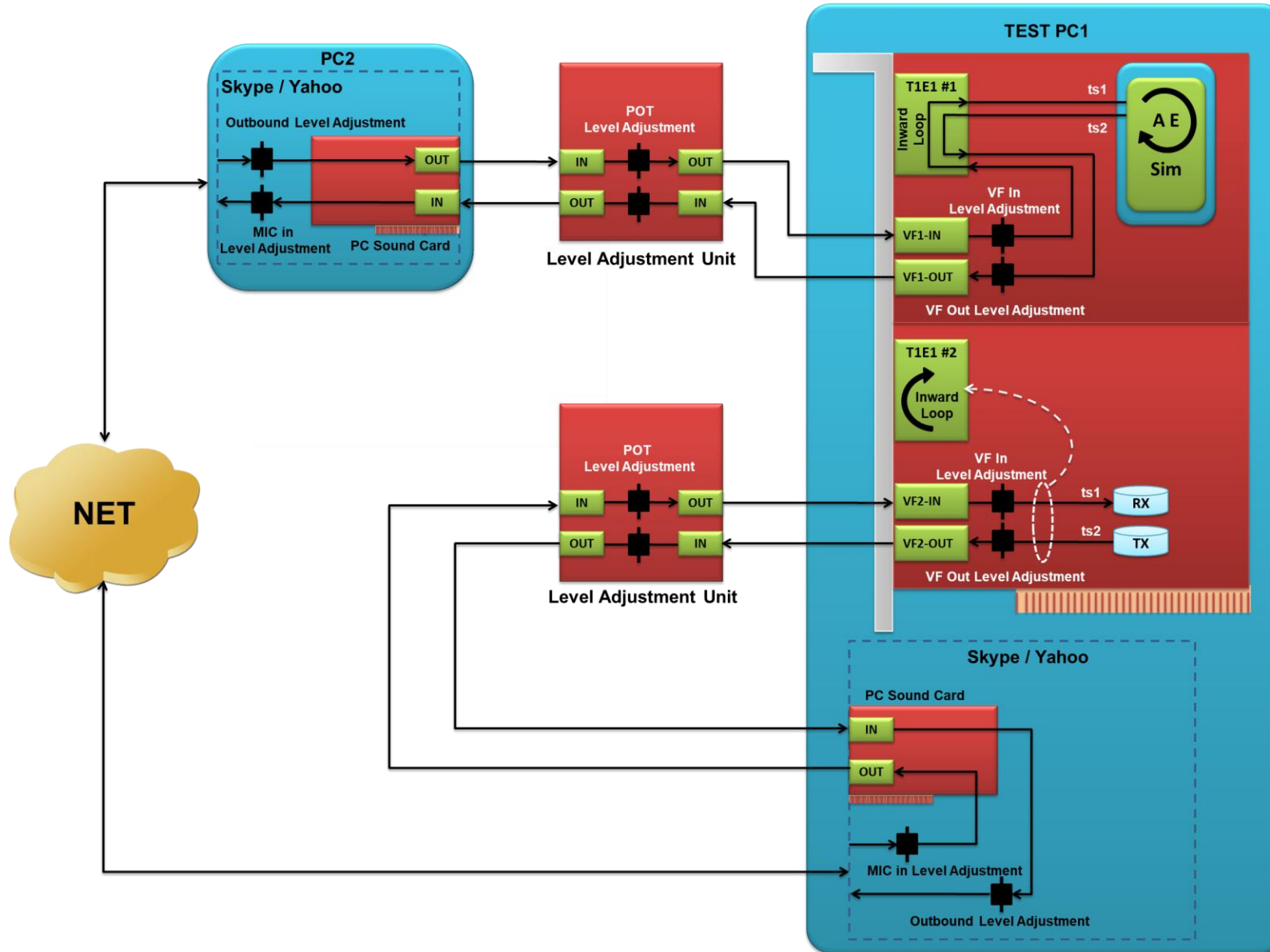
VOIP – TDM Acoustic Echo Simulation using DEC



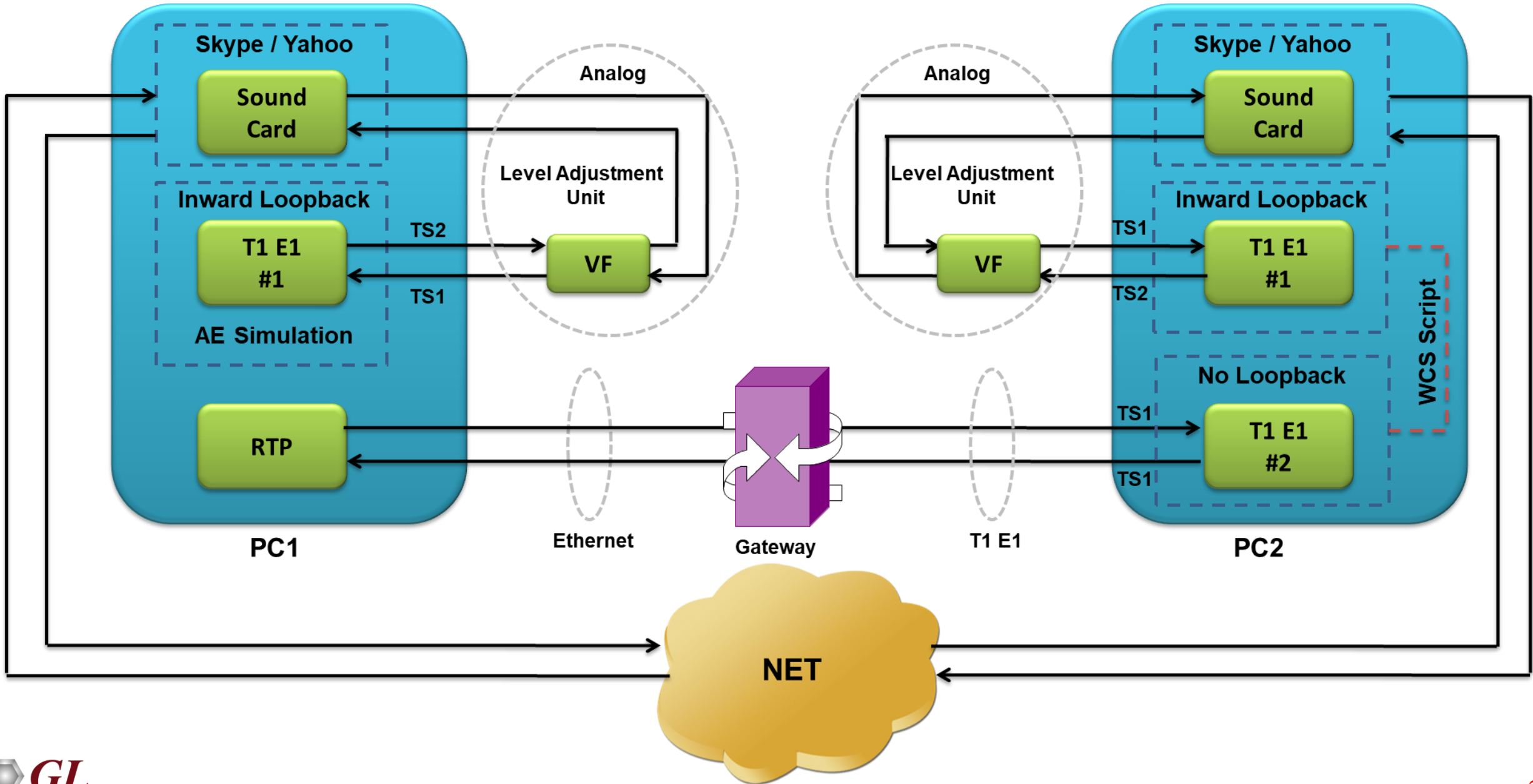
VoIP – TDM for Acoustic Echo Canceller Simulation using Gateway



TDM – TDM using Skype/Yahoo

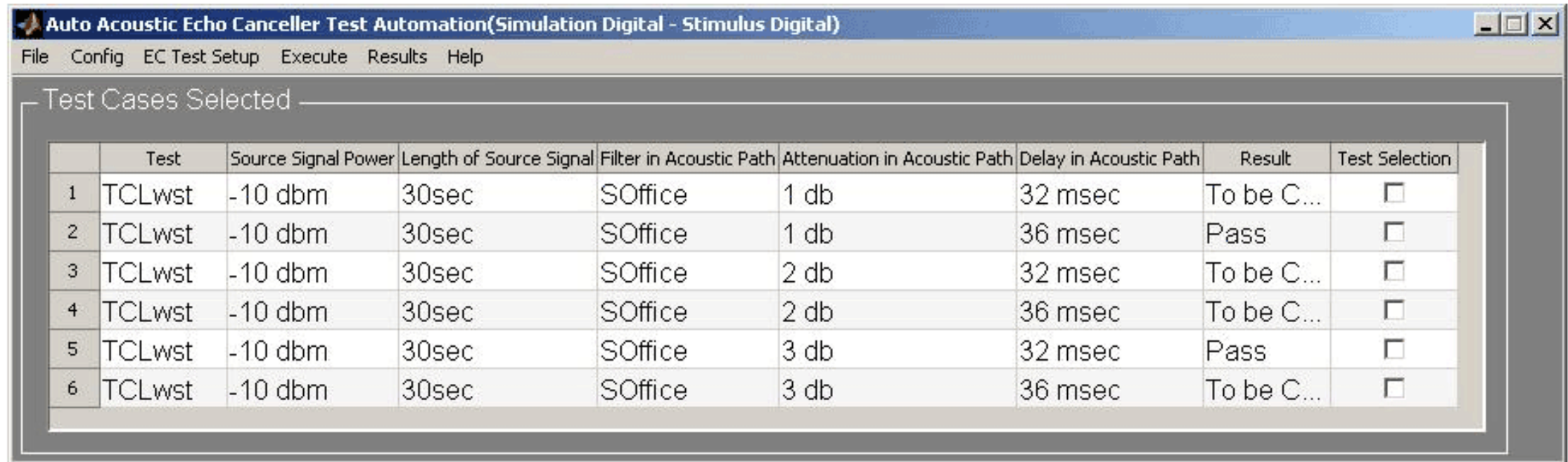


VoIP – TDM using Skype/Yahoo



Configure Test Cases

- For teleconference systems and for hands-free communication on both sides, TCLwst shall be at least 40 dB
- For hands-free telephones and videophones interworking with distant users connected to the PSTN, TCLwst shall be at least 45 dB
- For mobile radio systems, TCLwst shall be at least [45 dB] when no acoustic noise is added at the Sin interface
- Test cases executed at least once, displays 'pass' or 'fail' in result column



The screenshot shows a software window titled "Auto Acoustic Echo Canceller Test Automation(Simulation Digital - Stimulus Digital)". The window has a menu bar with "File", "Config", "EC Test Setup", "Execute", "Results", and "Help". Below the menu bar, there is a section titled "Test Cases Selected" containing a table with 9 columns: "Test", "Source Signal Power", "Length of Source Signal", "Filter in Acoustic Path", "Attenuation in Acoustic Path", "Delay in Acoustic Path", "Result", and "Test Selection". The table contains 6 rows of test cases.

	Test	Source Signal Power	Length of Source Signal	Filter in Acoustic Path	Attenuation in Acoustic Path	Delay in Acoustic Path	Result	Test Selection
1	TCLwst	-10 dbm	30sec	SOffice	1 db	32 msec	To be C...	<input type="checkbox"/>
2	TCLwst	-10 dbm	30sec	SOffice	1 db	36 msec	Pass	<input type="checkbox"/>
3	TCLwst	-10 dbm	30sec	SOffice	2 db	32 msec	To be C...	<input type="checkbox"/>
4	TCLwst	-10 dbm	30sec	SOffice	2 db	36 msec	To be C...	<input type="checkbox"/>
5	TCLwst	-10 dbm	30sec	SOffice	3 db	32 msec	Pass	<input type="checkbox"/>
6	TCLwst	-10 dbm	30sec	SOffice	3 db	36 msec	To be C...	<input type="checkbox"/>

Initialize GL Cards

Initialize GL Cards

GL Card 1 Setting

Framing: CCS + CRC
CAS
CCS

Linecoding: HDB3

Mode: Terminate
Bridge
Monitor

Clock: Internal
Recovered

Loopback: No Loopback
Outward Loopback(D)
Inward Loopback(D)
Inward Loopback(F)

GL Card2 Setting

Framing: CCS + CRC
CAS
CCS

Linecoding: HDB3

Mode: Terminate
Bridge
Monitor

Clock: Internal
Recovered

Loopback: No Loopback
Outward Loopback(D)
Inward Loopback(D)
Inward Loopback(F)

GL's Server Setting Required

Work with Analyzer
 Work without Analyzer

Port Number: 17090

Message Type: ASCII
Binary

Message Version: 3
4

Server Response Time (ms): 12

Server Latency (ms): 12

Card Selection

Universal E1 Cards

Quit Initialization

Apply and Close

RS232 Control Settings

Echo Cancellor Control Settings

Echo Cancellor Status Control Command Sets

Command Response Delay Time in msec: 1000

Log on EC: log on

Log off EC: log off

Select channel n: select all

Set EC online: enable EC

Set EC offline: bypass EC

Enable EC Adaptation: enable adaptation

Disable EC adaptation: freeze H-reg

Clear H-register: clear H-reg

Unclear H-register: unclear H-register

Serial Port (RS232) Configuration

Connect using: COM1

Port Configuration

Bits per second: 9600

Data bits: 8

Parity: None

Stop bits: 1

Flow control: Xon/Xoff

TTL Controls

TTL: COM2

Send "Start/Stop" string?

Options for EC Control Setting GUI

Reset

Quit

Save to File

Load from File

Apply & Close

Test Parameters for TCLwst

The screenshot displays the AEC_E1_setup software interface, which is divided into several sections for configuring test parameters.

Test Signal Settings:

- CSS Levels(dBm0): [-10 0]
- CSS File: C:\Program Files\GL Communica
- Time(s): [60 80]

Echo Path Simulation Settings:

- ERL(dB): [1 2]
- Delay(ms): [32 34]
- Filter Type: Dynamic Small Office
- Dynamism: Medium

Select Test Cases:

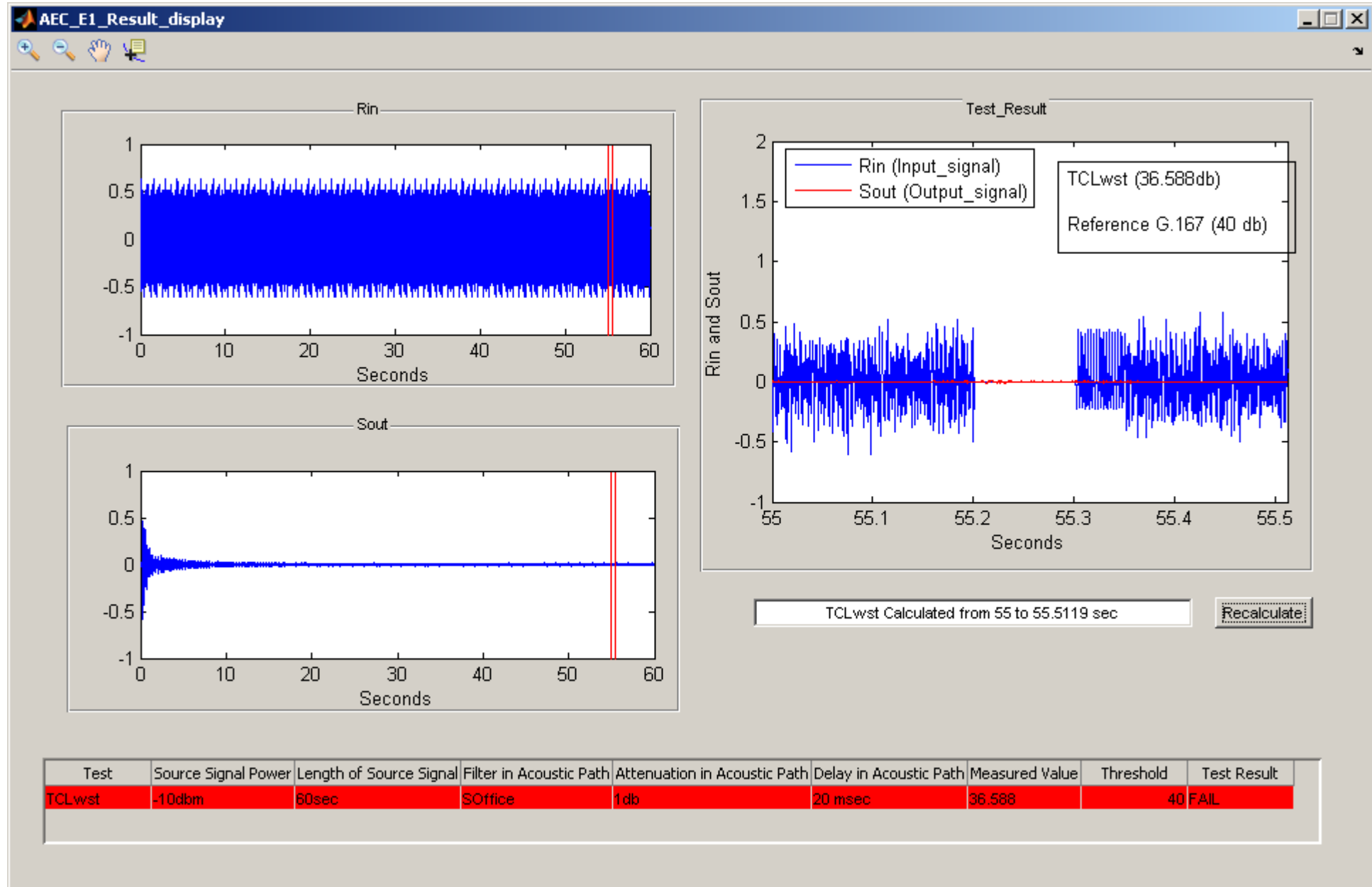
A grid of buttons for selecting test cases, with 'TCLwst' highlighted in yellow. The buttons include: TCLwst, TCLvdt, Ardt, Asdt, Drdt, Dsdt, PR, Trnst, Trodt, Tic, THdt, TCLtdt, and ERLtdt.

Test Setting Monitoring:

- Overall EC Test Setup: Summary of Test Setup, Total Number of Tests= 1, TCLwst has 16 cases.
- Parameters for Each Test: TCLwst, Selected= Yes, FilterType= Dynamic Small Office, Dynamism= Medium, ERL= 1 2 dB, Delay= 32 34 ms, Time= 60 80 sec, CSSLevel=-10 0 dBm0.

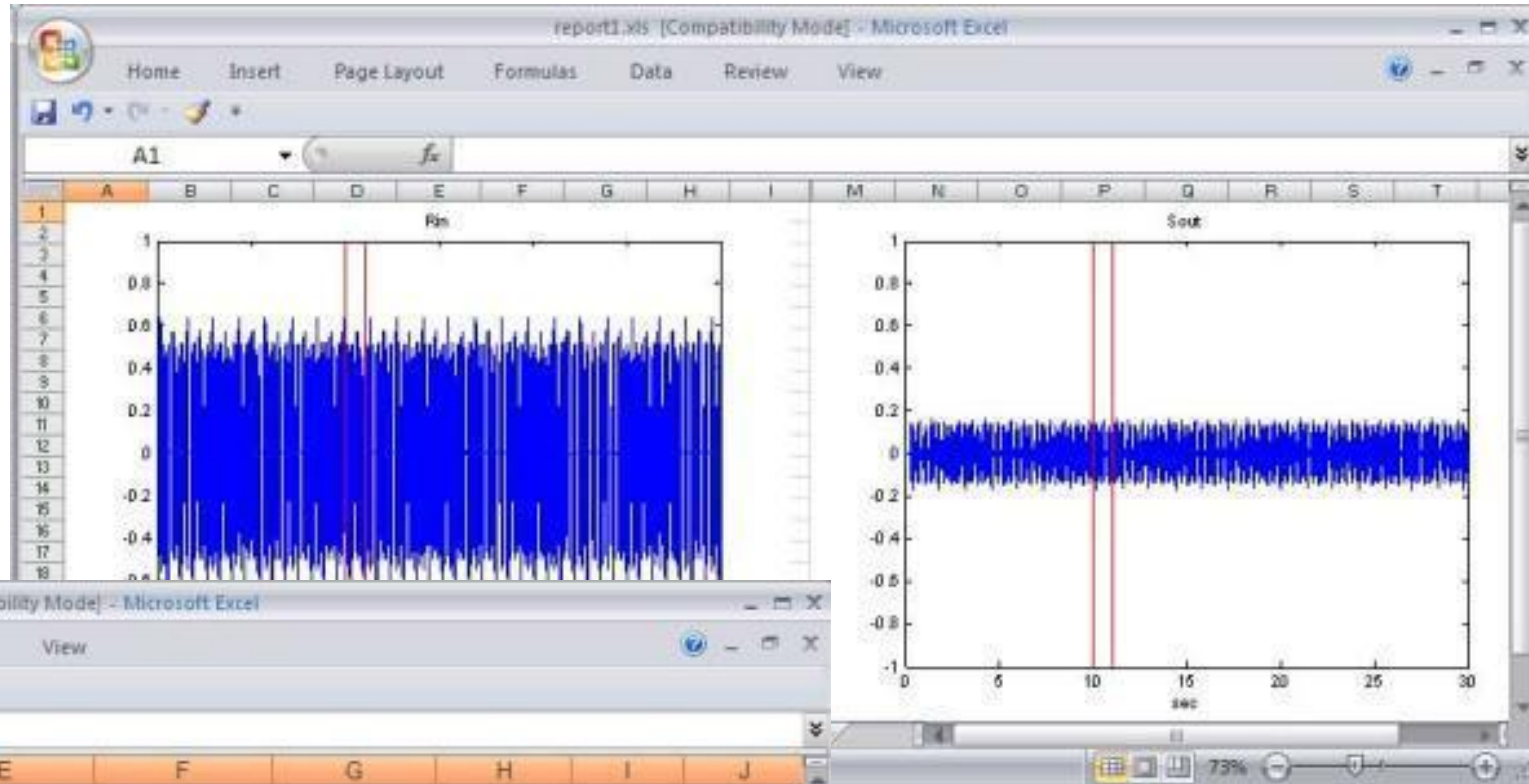
At the bottom of the interface, there are five buttons: Reset, Save, Load, Default, and Apply.

Result Display



Report Analysis and Plot Results

- Generation of report with the plots (Report Analysis) and plotting of Rin and Sout waveforms with option for recalculation of test parameter across different region in the waveform (Plot Results)

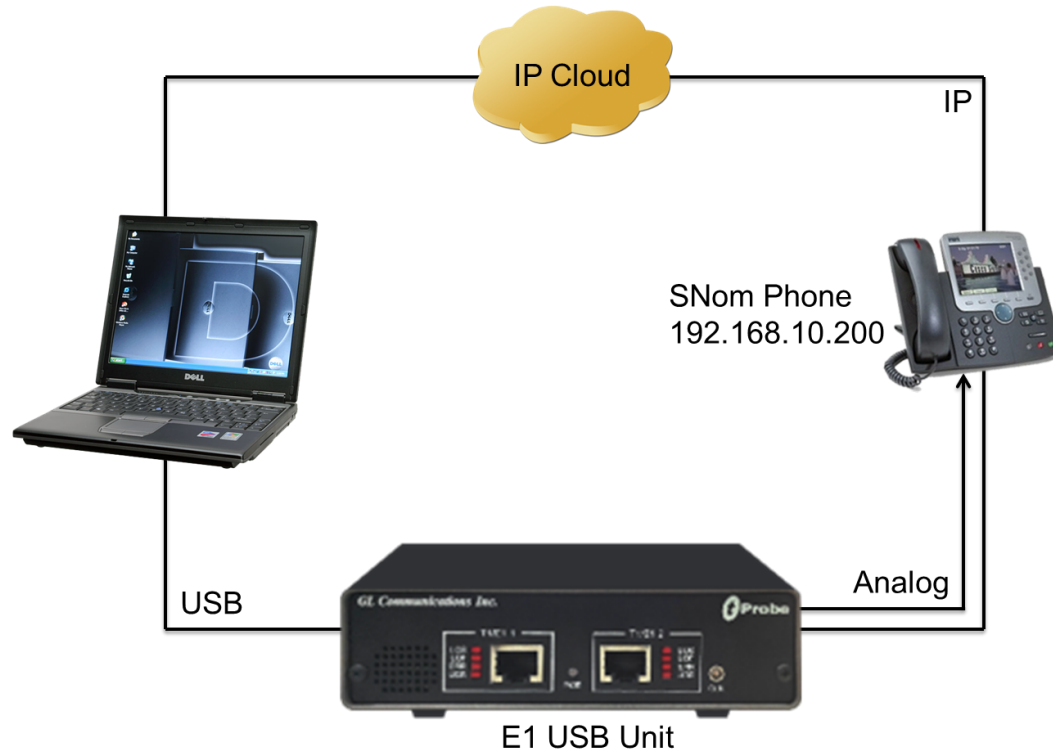


The screenshot shows the Excel report table with the following data:

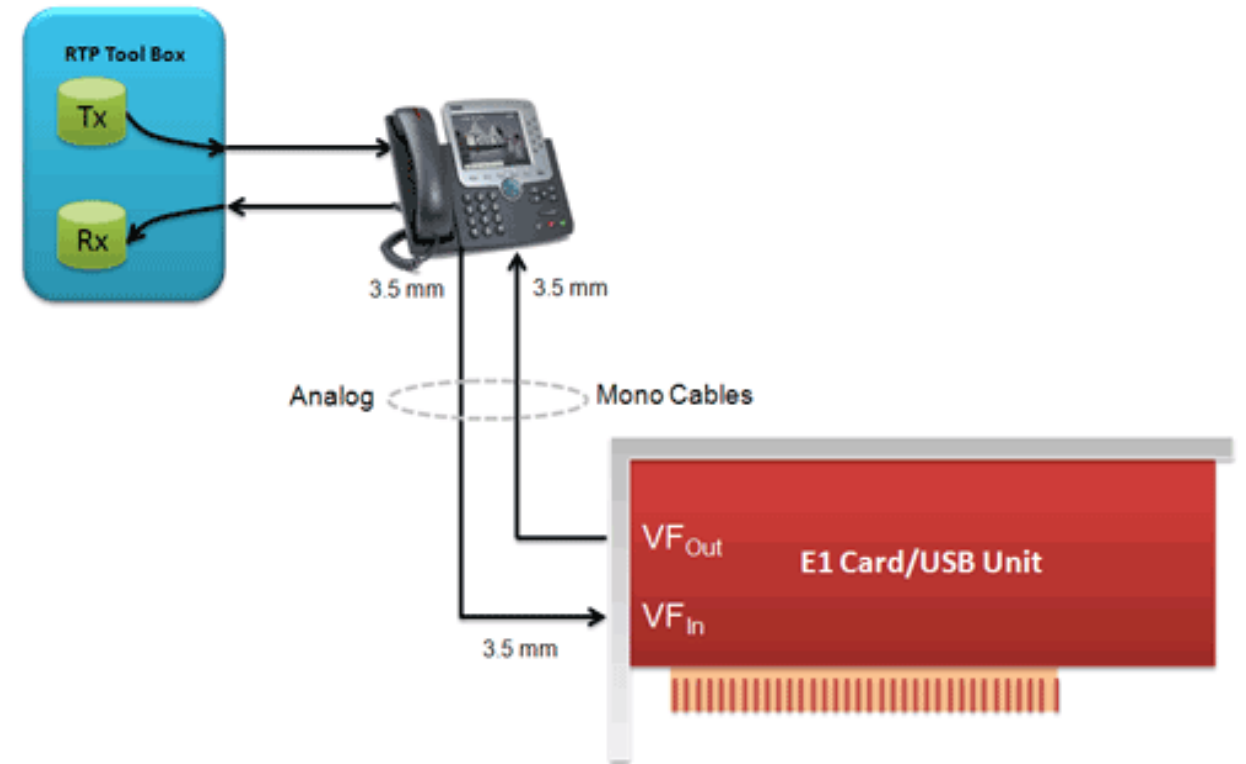
Test	Source Signal Power	Length of Source Signal	Filter in Acoustic Path	Attenuation in Acoustic Path	Delay in Acoustic Path	Tested Value	Threshold	Result	Files
TCLwst	-10 dbm	30sec	SOffice	0 db	32 msec	-0.55032 db	40 db	Fail	Rin_Sout
TCLwst	-10 dbm	30sec	SOffice	5 db	32 msec	4.4532 db	40 db	Fail	Rin_Sout
TCLwst	-10 dbm	30sec	SOffice	10 db	32 msec	9.4634 db	40 db	Fail	Rin_Sout
TCLwst	-10 dbm	30sec	SOffice	15 db	32 msec	14.4676 db	40 db	Fail	Rin_Sout
TCLwst	-10 dbm	30sec	SOffice	20 db	32 msec	19.4805 db	40 db	Fail	Rin_Sout
TCLwst	-10 dbm	30sec	SOffice	25 db	32 msec	24.5189 db	40 db	Fail	Rin_Sout
TCLwst	-10 dbm	30sec	SOffice	30 db	32 msec	29.5556 db	40 db	Fail	Rin_Sout

Auto AEC within SNom IP Phone

- As depicted in the setup the AEC is within the SNom IP phone
- The AEC performance is limited to A-law transmission



- Auto AEC Compliance Testing software is run in the host computer that is in PC1
- Respective E1 card's analyzer software is run in PC1
- RTP Toolbox™ can be run on same machine or on another PC



Auto AEC Supported Test Cases (G.167, P.340)

Test Cases	Description	G.167	P.340
TCLwst	Weighted terminal coupling loss – single talk	Yes	Yes
TCLwdt	Weighted terminal coupling loss – double talk	Yes	Yes
Ardt	Received speech attenuation during double talk	No	No
Asdt	Sent speech attenuation during double talk	No	No
Drdt	Received speech distortion during double talk	No	No
Dsdt	Sent speech distortion during double talk	No	No
Pr	Maximum frequency shift (or pitch ratio)	No	No
Tonst	Break-in time – simple talk	Yes	Yes
Tondt	Break-in time – double talk	Yes	Yes
Tic	Initial convergence time	No	No
Trdt	Recovery time after double talk	No	No
TCLwpv	Terminal coupling loss during echo path variation	No	No
Trpv	Recovery time after echo path variation	No	No

Thank you