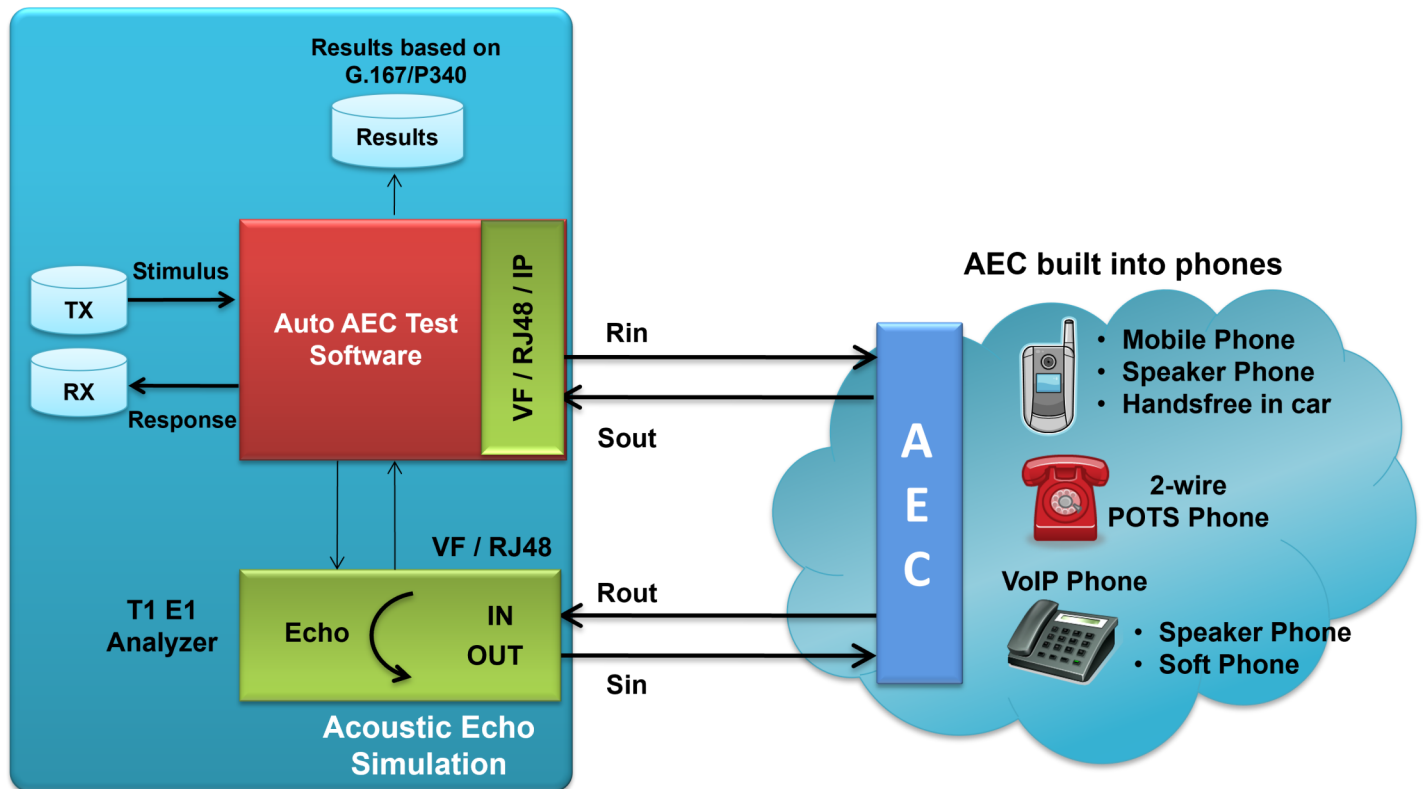


Acoustic Echo Compliance Test Software

(As per G.167 and P.340 Standards)



Overview

Acoustic echo is a common phenomenon that is encountered in many types of phone calls. It occurs when speaker output is fed back to the microphone input. This will disturb the far end speaker as they hear their own voice but delayed. Acoustic echo cancellers (AEC) are used in phones or in the network to minimize this distortion. Acoustic echo, unlike line echo, is dynamic during a call as people and speakers move about.

GL's Automated Acoustic Echo Cancellation (AEC) Test software has been developed and tested to perform acoustic echo cancellation testing in accordance with ITU-T Specifications, G.167 (03/1993) and P.340 (05/2000).

The Automated AEC Test Software uses GL's T1 E1 Analyzer products and the customers AEC hardware or software to perform Acoustic Echo Canceller testing. R_{in} and S_{in} files (stimulus and echo) are prepared by Automated AEC Test software in accordance with user inputs. R_{out} and S_{out} are captured and processed.

For details, refer to [Acoustic Echo Compliance Test Software](#) webpage.



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Main Features

- Simulates an actual acoustic echo path with acoustic filter types (Small, Medium, Large Office), Echo path delays and losses
- Features such as filter, attenuate, and delay are available as along with a slow filter coefficient variation as a function of time to simulate a real acoustic environment
- Real-time as well as off-line analysis with tabular Pass/Fail results
- Simulates acoustic echo for Analog (Mobile Phone), digital (Gateway), and packet (VoIP to TDM with Gateway/IP phone) networks
- Auto or Manual control of the Automated Acoustic Echo Canceller Test Software during testing
- Auto analysis of the response according to G.167 (03/1993) and P.340 (05/2000) requirements
- Detailed graphical and tabular results for individual and overall test
- Generation of report with the plots (Report Analysis)
- Options to recalculate test parameter across different region in the waveform (Plot Results)
- Option to zoom-in on any test results to investigate further
- Supported on Windows® operating system with user-friendly Graphical User Interface
- Compatible with GL's tProbe™ T1 E1 Analyzer and Dual PCIe Express cards

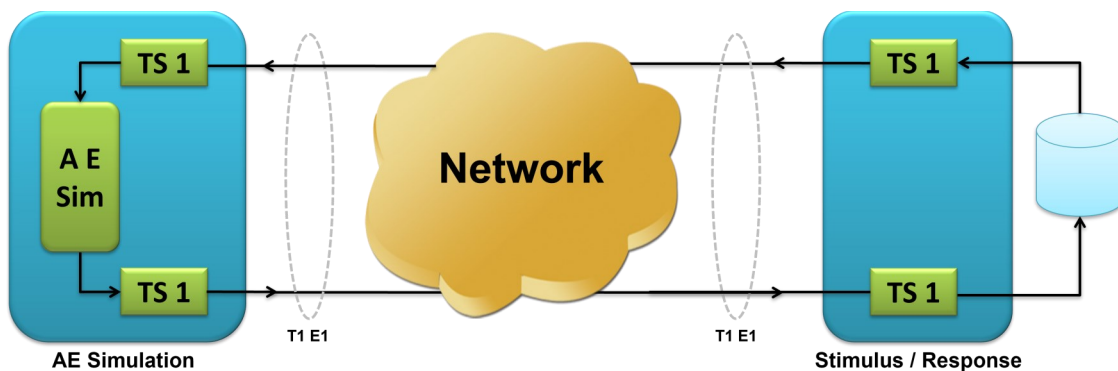
Automated AEC Testing Scenarios

To test AECs, stimulus signals are generated and the response is captured at Stimulus/Response End. At the other end, acoustic echo is simulated; this is called the Acoustic Echo Simulation End. The following are the AEC testing concepts implemented within this software:

- Stimulus / Simulation all Digital (TDM Applications)
- Stimulus / Simulation all Analog (Mobile Phone Applications)
- Stimulus RTP (Ethernet) / Simulation Analog or Digital (VoIP IP Phone Applications)

Stimulus / Simulation all Digital (TDM Applications):

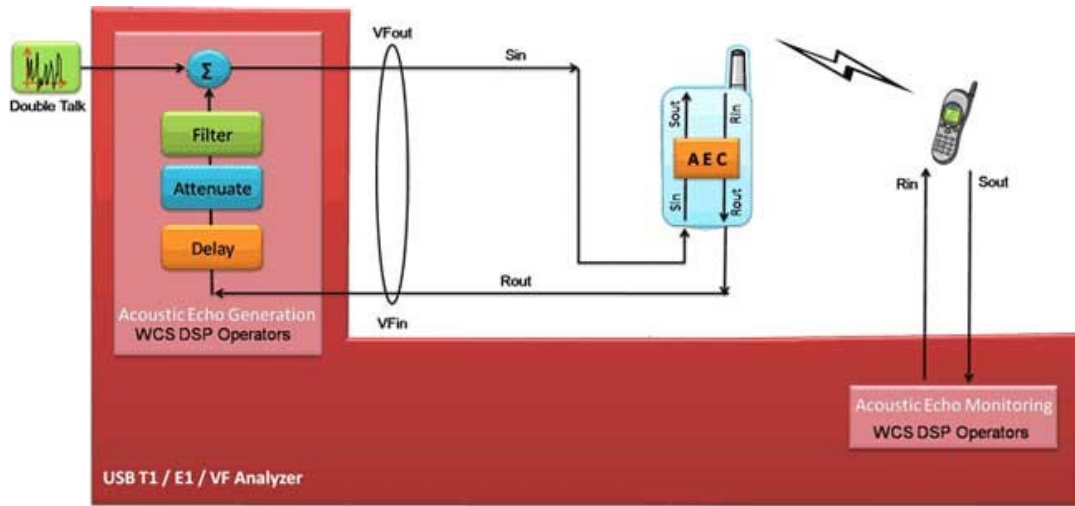
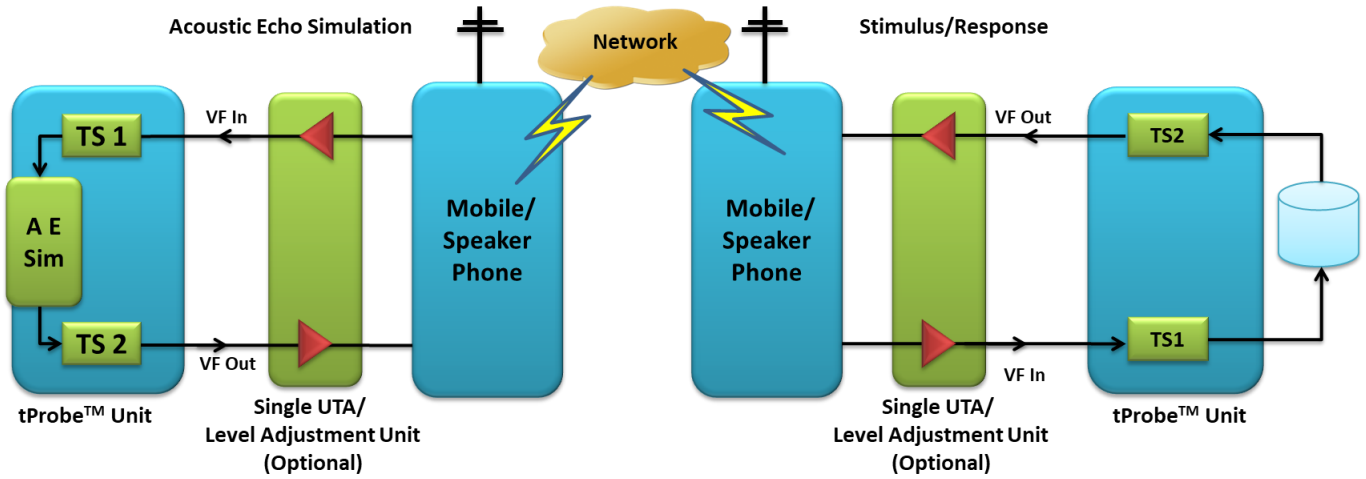
In this scenario, the AEC is assumed to be located in the network. Acoustic echoes are simulated within the GL's T1 E1 platforms digitally. The generation of the stimulus signal and the capture of the response signal are also performed by GL's T1 E1 platforms.



Stimulus / Simulation all Analog (Mobile Phone Applications):

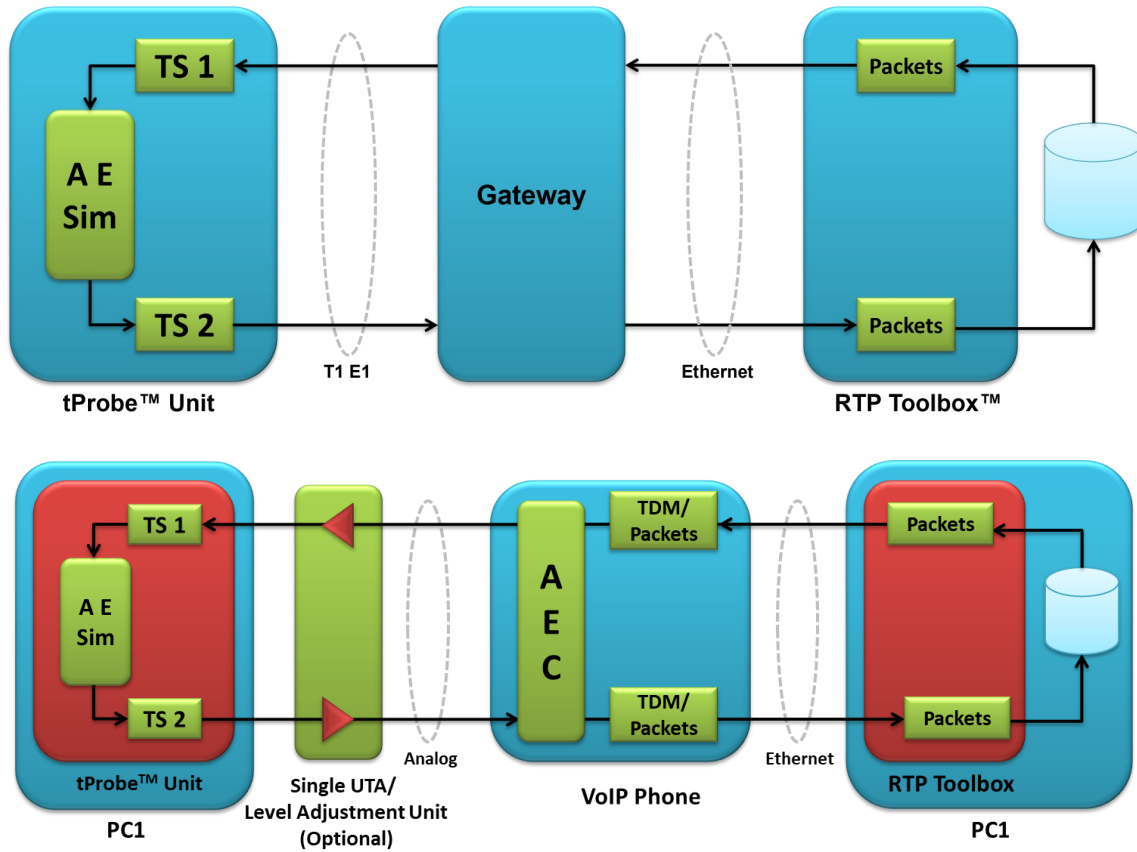
In this scenario, the AEC is assumed to be in a mobile phone and accessed through an analog interface. Again, GL's T1 E1 platforms with analog interfaces are used to convert analog signals to digital and subsequent processing is performed digitally. Level adjustment accessories are used between mobile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

Simulation Analog – Stimulus Analog (TDM to TDM - Mobile Applications) for 8 bits (TS1 and TS2) and for 16 bits (TS1, TS2, TS3, and TS4).



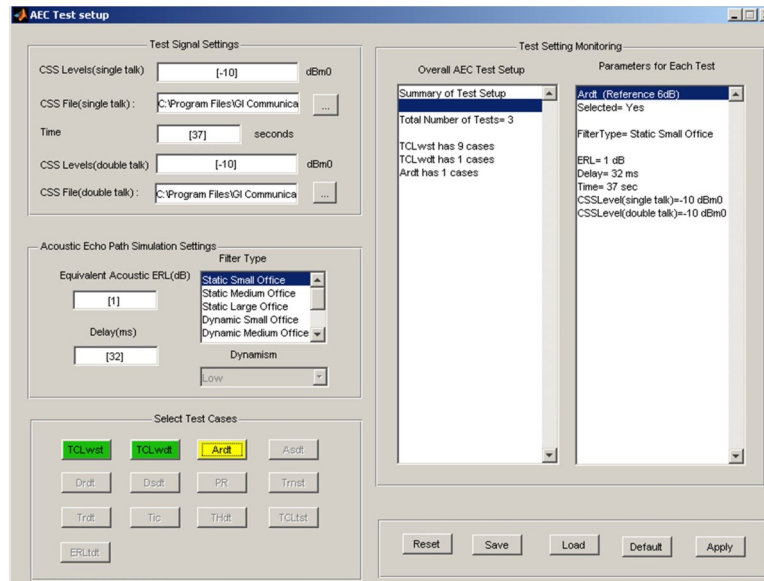
Stimulus RTP (Ethernet) / Simulation Analog or Digital (VoIP IP Phone Applications):

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. Simulation Digital – Stimulus RTP for 8 bits (TS1 and TS2) and for 16 bits (TS1, TS2, TS3, and TS4).



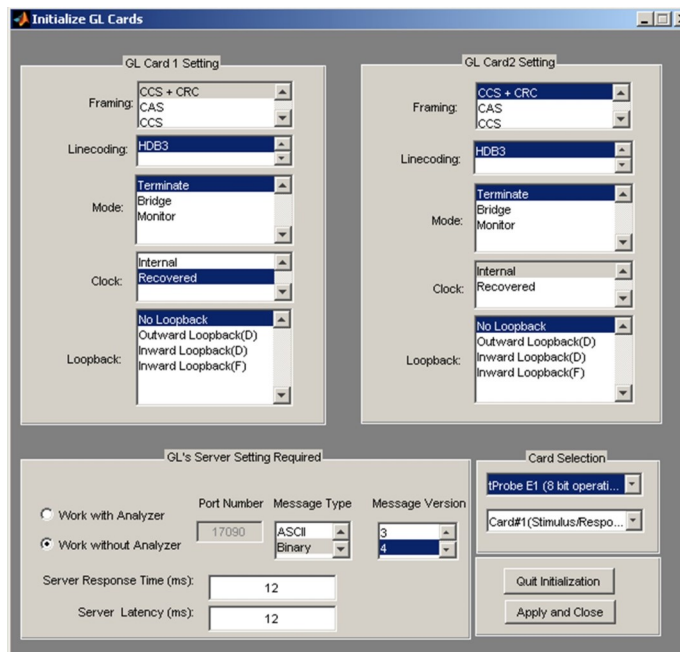
Test Parameters as per G.167

- Auto AEC test software allows you to set the parameters for each test per ITU-T G.167. These parameters include: CSS level, attenuation (ERL), Acoustic filter types (Static and dynamic kinds of Small Office, Medium Office, Large Office and room impulse response (RIR) generator based on room parameters), Echo path delay and losses
- The parameters can be saved into a file and a preset configuration file can be read in for establishing the test cases to be run
- Test Signal Settings - provides options to set dBm level, file and length of the signal in seconds
- Acoustic Echo path parameters - includes attenuation (ERL) during the acoustic path, delay and the filtering types which can be both static and dynamic
- For the case of the dynamic filter operation, an option for low, medium and high dynamism is given
- Option to select suitable test cases
- Overall EC Test Setup displays the total number of test cases based on different values provided at CSS Level, time, ERL, delay



Working with T1 E1 Products

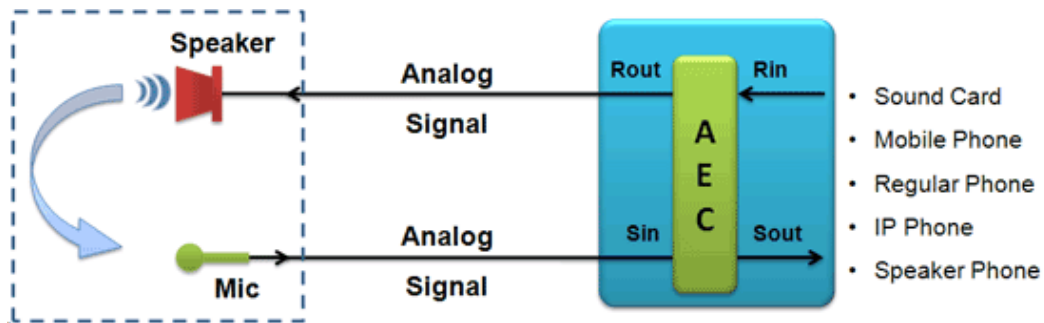
AEC Test software is available with GL's T1 E1 product platforms, including [Dual PCIe Express Cards](#), and [tProbe™ T1 E1 units](#). GL's tProbe™ T1 E1 Analyzer is featured with the Windows Client/Server DSP Operation module, which allows real-time testing using DSP commands to perform functions such as Amplification/Attenuation, Delay, Filter, File Tx/Rx, Logical operations, Echo Cancel, and so on.



Theory of Operation

The Automated AEC Test Software uses GL Communications' T1 E1 Analyzer products and the customers AEC hardware or software to perform Acoustic Echo Canceller testing.

During transmission and reception, the R_{in} and S_{in} (with echo) stimulus files (by frequently polling) are provided by AEC Test software. The output files S_{out} generated and possibly R_{out} are given back to the AEC Test software for analysis. AEC Test Software performs a full analysis (with detailed displays) that results in a "Pass" or "Fail". Automated AEC testing concepts are implemented within the software for various End to End Applications (Mobile, TDM, and VoIP) scenarios.



AEC Test Case Execution

Parameter settings are configured for each test case, which are displayed in the "Test Cases Selected" table as shown below. Each test can be executed individually or all the tests simultaneously at a time. Every test case generates suitable .gls script. WCS executes the gls script with suitable parameters as displayed in the corresponding row for the test case. When a particular test case is executed at least once, result column displays 'pass' or 'fail' depending on the test results.

Auto Acoustic Echo Canceller Test Automation(Simulation Digital - Stimulus Digital)									
File Config EC Test Setup Execute Results Help									
Test Cases Selected									
	Source Signal Power	Length of Source Signal	Dtalk Signal Power	Filter in Acoustic Path	Attenuation in Acoustic Path	Delay in Acoustic Path	Result	Test Selection	
1	-10 dbm	38sec		SOffice	2 db	32 msec	Fail	<input type="checkbox"/>	
2	-10 dbm	35sec		SOffice	2 db	32 msec	To be C...	<input checked="" type="checkbox"/>	
3	-10 dbm	40sec		SOffice	2 db	32 msec	To be C...	<input type="checkbox"/>	
4	-10 dbm	38sec		SOffice	1 db	32 msec	To be C...	<input type="checkbox"/>	
5	-10 dbm	35sec		SOffice	1 db	32 msec	To be C...	<input type="checkbox"/>	
6	-10 dbm	40sec		SOffice	1 db	32 msec	To be C...	<input type="checkbox"/>	
7	-10 dbm	38sec		SOffice	3 db	32 msec	To be C...	<input type="checkbox"/>	
8	-10 dbm	35sec		SOffice	3 db	32 msec	To be C...	<input type="checkbox"/>	
9	-10 dbm	40sec		SOffice	3 db	32 msec	To be C...	<input type="checkbox"/>	

Set RS 232 control commands (Auto Mode)

- Auto AEC test software can be run in two modes: Auto and Manual modes. Currently auto mode is envisioned to be alias to auto mode in GL's Auto EC (Line Echo Canceller) compliance testing. Different control mechanism will be described as customers and users have implemented
- In default Auto mode, proper COM port settings are necessary and the EC control commands needs to be typed in
- These commands are saved to an internal file. During tests, the appropriate commands will be sent per G.167 and P.340 requirements
- Currently the tests cases as per G.167 and P.340 supports only manual mode of operation

Echo Canceller Control Settings

Echo Canceller 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

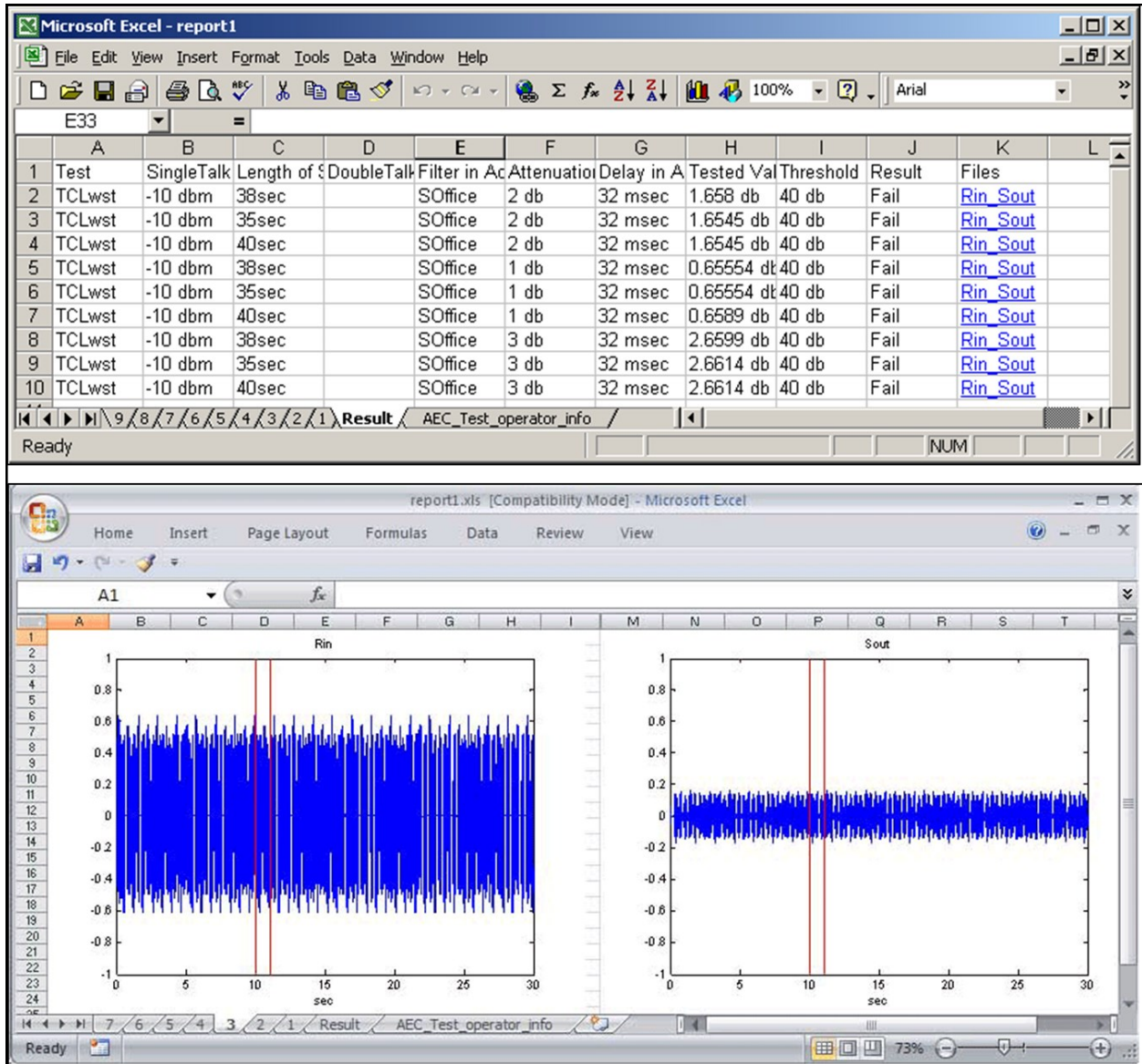
Load from File

Apply & Close

AEC Test Software Results

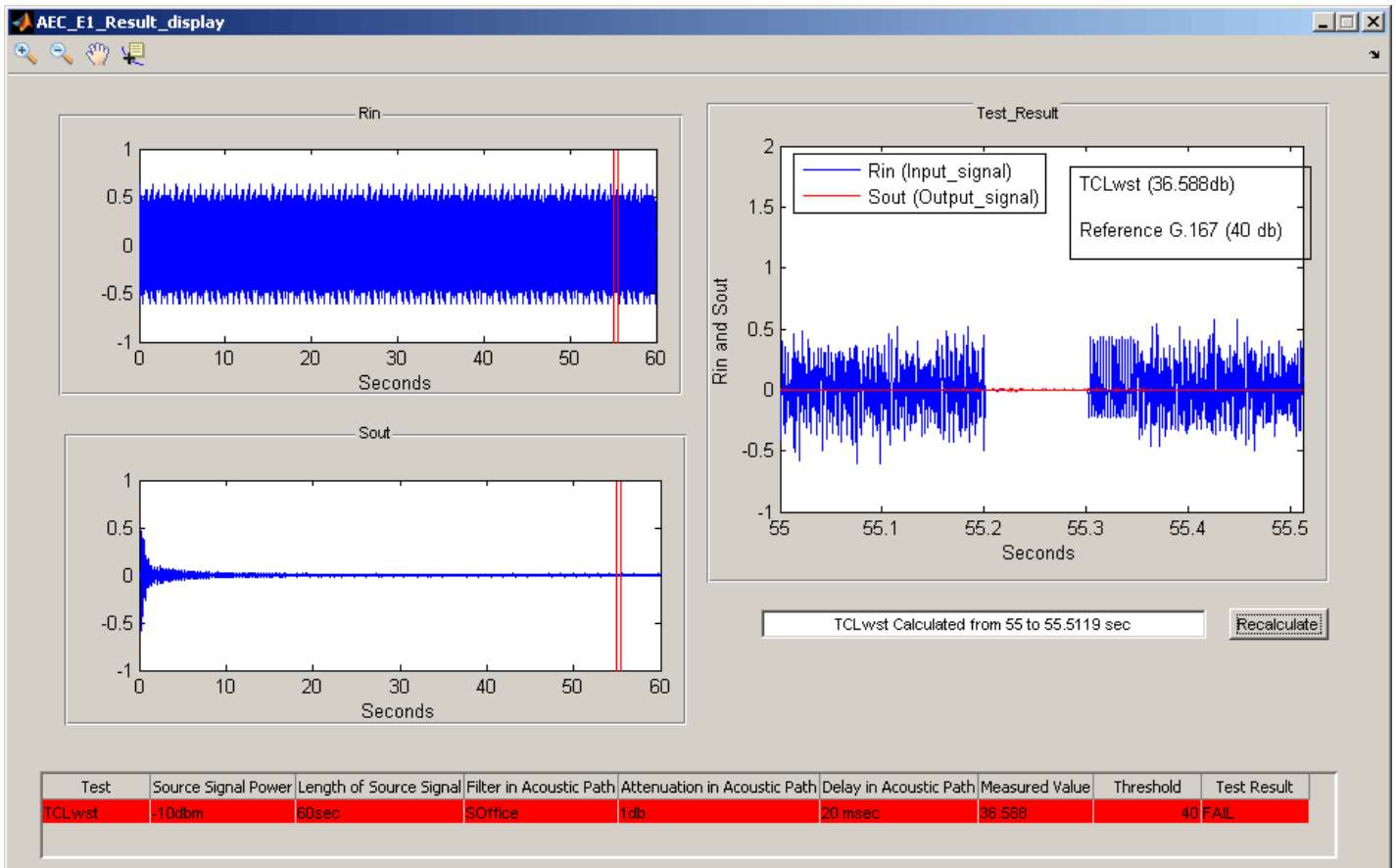
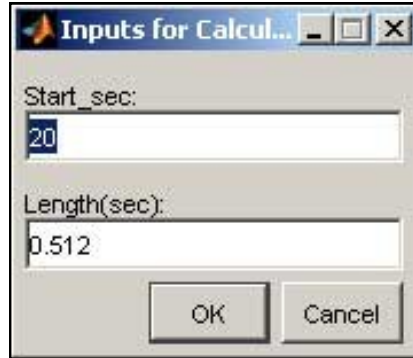
Result Analysis

Report Analysis generates reports and plots R_{in} and S_{out} waveforms. Auto AEC Test Software performs a full analysis (with detailed displays) that results in a "Pass" or "Fail". The graphs below depict the result analysis per G.167. For the 'Pass' cases, both the convergence time and the residual should meet the requirements of G.167. For the 'Fail' cases, either one (convergence or residual) or both (convergence and residual) does not meet the requirements of G.167.



Plot Results

Plot Result option enables to recalculate test parameter across different regions in the waveform. The plot result displays R_{in} , S_{out} files and part of the R_{in} and S_{out} files used to calculate the test parameter. Red background color indicates test fail and green indicates test pass. The part of the file used for calculation is also displayed in seconds. The user can recalculate the test parameter providing necessary valid information as shown below. Users can change the recalculate options, the current start point of calculation of the test parameter and length used for it.



Buyer's Guide

Item No	Product Description
PKB081	Automated Acoustic Echo Cancellation (AEC) Compliance Test Software

Item No	Related Software
XX067	Automated Echo Canceller Testing w/o VQT (Includes XX019 or XX600, XX610, and XX630 w/dongle)
AEC001	Automated Echo Canceller Test Viewer
XX068	Semi-Automated and Scripted EC Testing Suite
XX065	Manual G.168 EC Test Suite for T1 & E1 (with GLC View, XX020, XX062, XX063, XX066)
PKBT67	Automated Echo Canceller Testing – T1 Version
PKBE67	Automated Echo Canceller Testing – E1 Version
PKB105	Manual G.168 EC Test Suite for ATAs & Gateways

Item No	Related Hardware
PTE001	tProbe™ T1 E1 Base Unit
FTE001	QuadXpress T1 E1 Main Board (Quad Port– requires additional licenses)
ETE001	OctalXpress T1 E1 Main Board plus Daughter Board (Octal Port– requires additional licenses)
XTE001	Dual Express (PCIe) T1 E1 Boards

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