



MODEL 3540 *VERSION 2*
**TELEPHONE NETWORK EMULATOR
AND VOICEBAND ANALYZER**



**User's Manual
Revision 2.1
May 2004**

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Document Number 3750121

TABLE OF CONTENTS

Table of Contents	2
Shipping Box Contents	3
Model 3540 Product Information.....	3
Safety Instructions	3
Product Warranty	4
Warranty Service	4
Calibration Service.....	5
Customer Service Contact Information	5
Model 3540 Hardware Description.....	6
Hardware Introduction	6
Power	6
Computer Connection	6
Front Panel Description	6
Rear Panel Description	6
Model 3540 Block Diagram.....	7
Model 3540 Software Description	8
Software Introduction	8
Application Software Installation	8
Software Driver Installation.....	9
Running the win3540 application	12
CO / Caller ID Configuration	13
Function Tabs.....	15
CO / Caller ID Setup.....	15
SMS	18
Measurements	21
Network Emulation	31
Monitor	33
Script	34
System.....	35
Script Commands.....	36
Model 3540 Specifications	44
Appendix 1: SMS Timing Parameters	49
Appendix 2: Options	51
Handset Emulation Option.....	51
PESQ.....	52

SHIPPING BOX CONTENTS

Each **Model 3540 Telephone Network Emulator and Voiceband Analyzer** includes:

- Model 3540
- User's Manual
- CD with the *Win3540* Application Software
- Power Cable
- Two Telephone Cables with RJ-11 connectors
- One USB Cable (A Male to B Male)
- Certificate of Calibration
- Warranty Registration Form

MODEL 3540 PRODUCT INFORMATION

Safety Instructions

1. Read and follow all warning notices and instructions marked on the product or packaging and included in this manual.
2. The Model 3540 should not be operated in environments where the ambient temperature exceeds 50° C (122° F). Care should also be given to ensure that adequate air circulation is available for the Model 3540.
3. The Model 3540 is designed for indoor use only. Extreme temperature or other outdoor conditions (rain and moisture) can damage the system.
4. Input AC power to the Model 3540 must be within 100 Vac to 250 Vac, and 50 Hz to 60 Hz. Higher voltages will damage the unit.
5. Equipment grounding is vital to ensure safe operation of the Model 3540. Do not connect the power cord to an AC receptacle that is not properly grounded.
6. The Model 3540 is designed to test standard telephone voltages and currents. Do not connect Channel A or Channel B to higher voltages or currents.
7. The case should not be opened for any reason. The Model 3540 contains no customer serviceable parts. Refer all servicing to Rochelle Communications or an Authorized Rochelle Distributor, Dealer, or Agent.

Product Warranty

- Rochelle Communications, Inc. warrants that the Model 3540 Telephone Network Emulator and Voiceband Analyzer will be free from defects in material and workmanship under normal installation for a period of one year from the original date of purchase.
- The obligation of Rochelle under this warranty shall be limited to repair or replacement (at our option) during the warranty period. Any part, which proves to be defective in material workmanship under normal installation, use, or service, is covered under the warranty, provided the product is returned to an Authorized Rochelle Distributor, Dealer, or Agent. **Note: Transportation or Shipping Charges are not the responsibility of Rochelle Communications, Inc.**
- The above warranty shall not apply to defects resulting from misuse, neglect, accident, destruction, alteration of the serial number, operation outside of the product environmental specifications, improper electrical voltages or currents, unauthorized modifications, or repair, alteration, or maintenance by any person other than Rochelle or an Authorized Rochelle Distributor, Dealer, or Agent.
- This warranty is in lieu of all other expressed warranties, obligations, or liabilities. Rochelle makes no expressed or implied warranties regarding the quality, merchantability, or fitness for a particular purpose beyond those that appear in this manual.
- In no event will Rochelle be liable for any special, incidental, consequential or punitive damages for breach of this warranty, expressed or implied, including, but not limited to, loss of profits or damages to business or business relations.

Warranty Service

- The Model 3540 must be returned to Rochelle or to an Authorized Rochelle Distributor, Dealer, or Agent for warranty service.
- A Return Material Authorization (RMA) number must be obtained from our Product Service Department at techsupport@rochelle.com before returning the Model 3540.
- Customer shall prepay shipping charges for products returned to Rochelle for warranty service. Rochelle shall pay shipping charges for the return of the serviced products to the customer. However, Rochelle cannot assume liability for duties and taxes for products returned to customers located outside the USA.
- Ship all product returns to:
Rochelle Communications, Inc.
Attn: Product Service Department
8906 Wall Street, Suite 205
Austin, Texas 78754 USA
- Out-of-Warranty repair rates are available from our Product Service Department. Repair charges are based on the repair rate at the time of the return.
- Rochelle will either repair or replace (at its option) a defective product not covered under warranty.

- The warranty on a serviced product is 90 days, starting at the date of service.

Calibration Service

- Rochelle Communications, Inc. recommends that the Model 3540 be calibrated on a regular interval of one year. Please refer to the Certificate of Calibration to determine the recommended date of the next calibration.
- When the Model 3540 is due for calibration, please contact Rochelle or an Authorized Rochelle Distributor, Dealer, or Agent. Calibration charges are available upon request from the Product Service Department.

Customer Service Contact Information

Telephone	+1 512.339.8188 (8:30AM to 5:30PM CST Monday - Friday)
Fax	+1 512.339.1299
E-mail	techsupport@rochelle.com

MODEL 3540 HARDWARE DESCRIPTION

Hardware Introduction

The Model 3540 is a desktop instrument to be used in laboratory and production areas for testing Caller ID and SMS-based network equipment and terminal equipment.

Power

The Model 3540 is powered by 100 Vac to 240 Vac (50 Hz to 60 Hz) input. Use the appropriate power cable and follow standard safety procedures for connecting the Model 3540 to an AC receptacle.

Computer Connection

The Model 3540 connects to a host computer running by Windows™ 98SE/2000/ME/XP via a USB connection. A USB cable is included with the product.

Front Panel Description

- **Two RJ-11 Modular Jacks:** Referred to as Channel A and Channel B. These are the access ports to devices under test.
- **Volume Control Knob:** Used to set the volume of the monitored audio on the speaker or on the headphone jack.
- **Headphone Jack:** Used for external headphones. Inserting a headphone jack will mute the speaker audio.
- **Power On LED:** Indicates the Model 3540 is turned on.
- **USB Link LED:** Indicates the USB link is active.

Rear Panel Description

- **The AC Power Receptacle:** To be connected only to 100 Vac to 240 VAC (50 Hz to 60 Hz).
- **Power Switch:** Turns the Model 3540 on and off.
- **Fan:** Keep the area behind the fan clear for at least 4 inches (10 cm).
- **USB Port:** Connects to the host computer.

Model 3540 Block Diagram

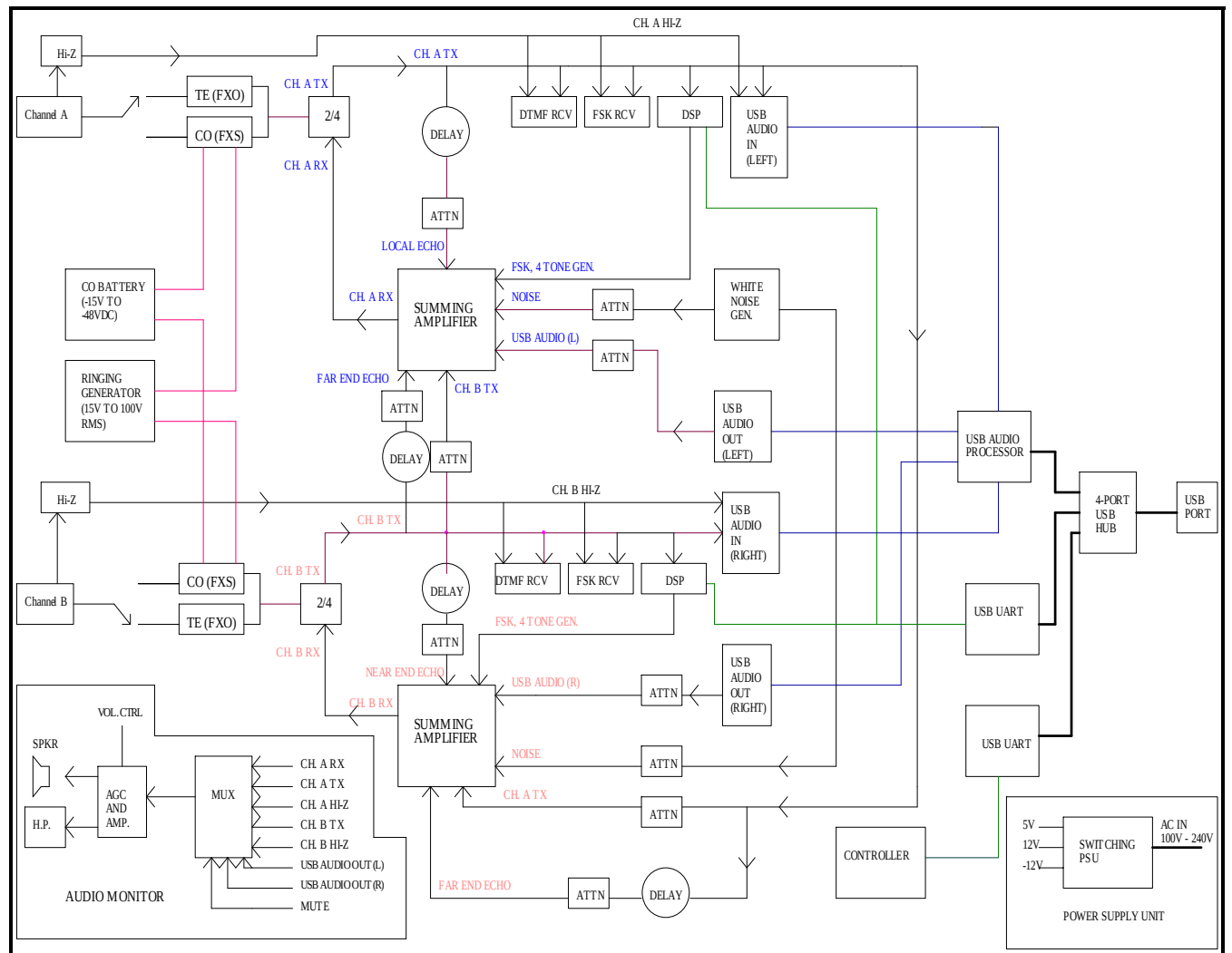


Figure 1 - Model 3540 Functional Block Diagram

MODEL 3540 SOFTWARE DESCRIPTION

Software Introduction

The Model 3540 ships with **Win3540**, a Windows-based application program, that provides menu-driven access to all Model 3540 functions.

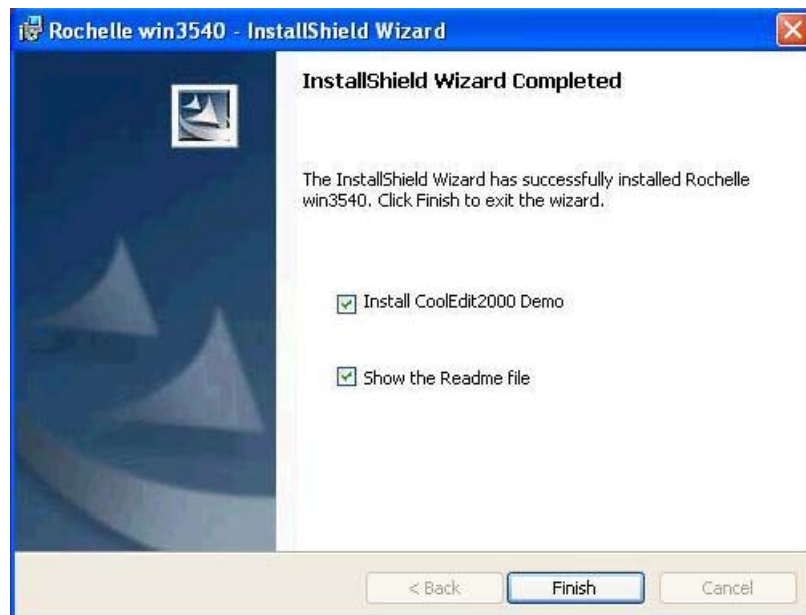
Win3540 is designed for operation under Windows™ 98SE, XP, ME, and 2000. We recommend a computer with 500 MHz (or better) and a minimum of 256 MB RAM

Application Software Installation

Before installing the win3540 application, we recommend that you first save all work and close all other applications. We also recommend you install win3540 on your PC before you connect the Model 3540 to the host computer.

Please follow the following steps in the order given below:

- Insert the win3540 CD into the CD-Rom drive of the host computer.
- The win3540 installation will start automatically if Autoplay is enabled on the computer,
- If Autoplay is not enabled, click on the Start button, then select Run and type x:\setup.exe, where "x" is the letter for the CD drive ("D" on most computers).
- The Setup program will then display the following InstallShield Wizard (**note**: your screen may appear slightly different depending on your version Windows).



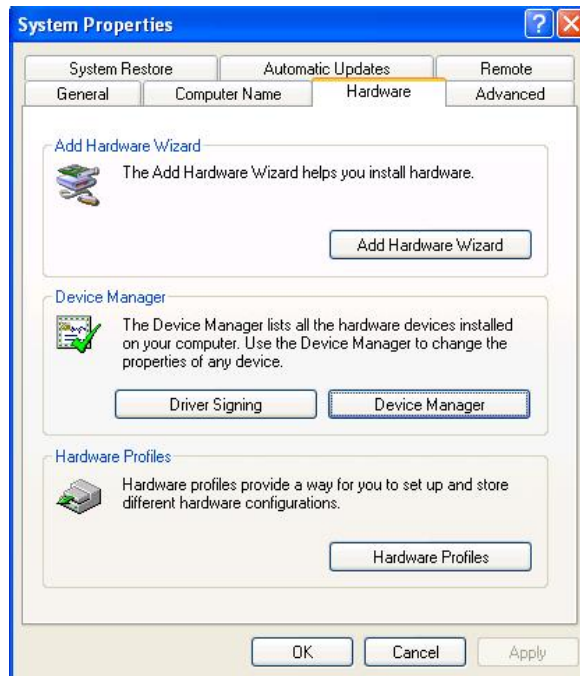
- Check the appropriate boxes and click the **Finish** button to complete the win3540 installation.
- Leave the CD in the CD-drive for the installation of the software drivers.

Software Driver Installation

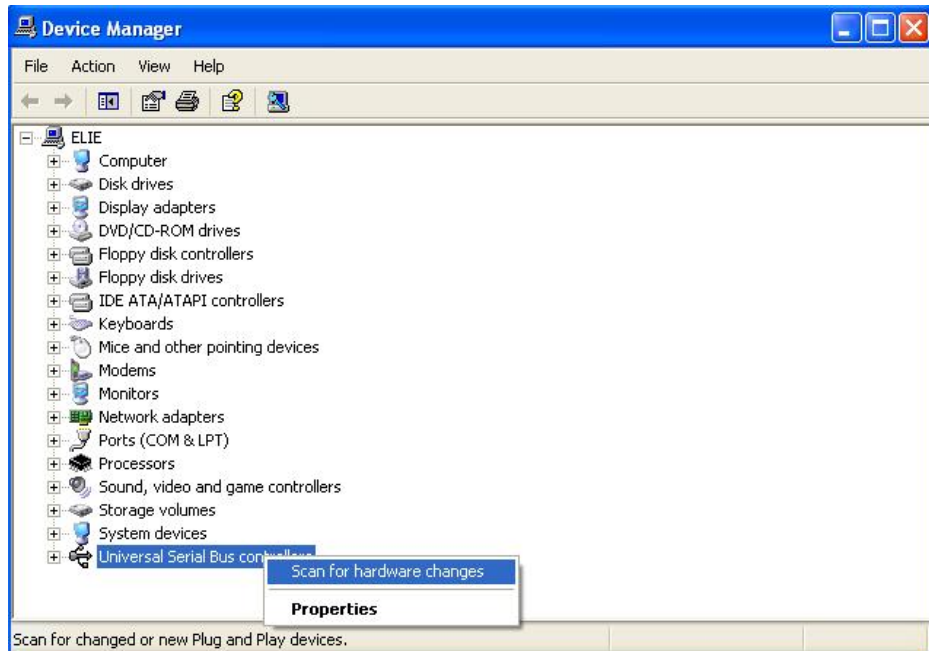
The Model 3540 requires two software drivers for proper operation.

Please follow the following steps in the order given below:

- The win3540 CD should still be in the CD drive from the Software Application Installation. If not, insert the win3540 CD in the CD-ROM drive.
- Using proper safety procedures, connect the power cable from the Model 3540 to an AC power outlet with 100 to 250 Vac.
- Connect the USB cable from the Model 3540 to the host computer.
- Turn on the Model 3540. A Green LED should illuminate on the front panel.
- Click on the Windows  button.
- Select **Settings, Control Panel, and System**. You should see the following screen (or a similar screen, depending on your operating system):



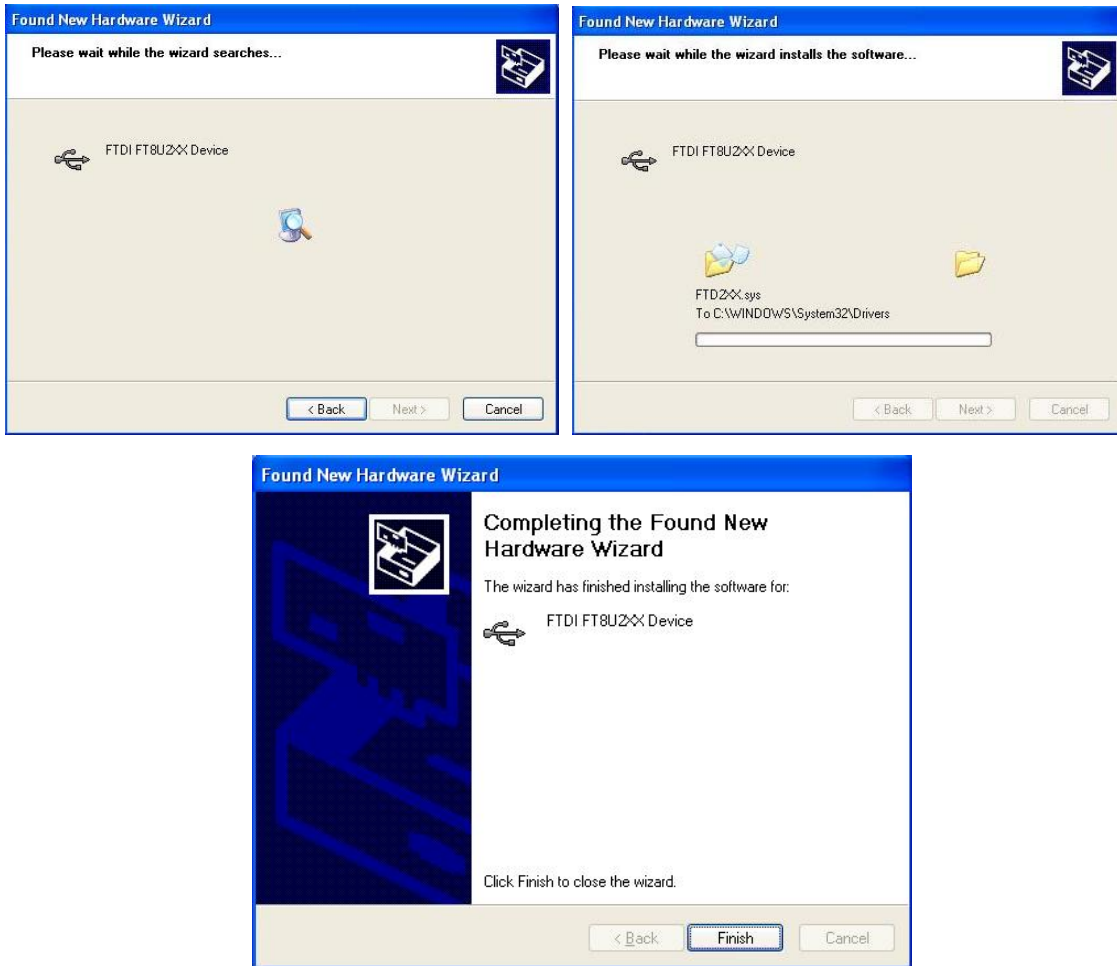
- Click on **Device Manager**. You should see the following screen (or a similar screen, depending on your operating system):



- Right Click on **Universal Serial Bus Controllers** and select **Scan for hardware changes**. You should see the following (or a similar) screen:



- Select **Install the software automatically (Recommended)** and click on the **Next** button. Click on **Next** and then **Finish** on the following screens:



This completes the installation of the FTDI FT8U2XX Device driver.

- The **New Hardware Wizard** should now display the following screen:



- Select **Install the software automatically (Recommended)** and click on the **Next** button. Click **Next** on the two screens while the **New Hardware Wizard** finds and installs the driver, then click **Finish** on the last screen:



This completes the installation of the FTDI FT8U2XX Device driver.

Note: Advanced users may elect to find the software drivers manually. They are located in the **\Temp\drivers** directory on the Model 3540 CD.

Please contact Rochelle Technical Service at techsupport@rochelle.com if you have any difficulty installing the win3540 software.

Running the win3540 application

To run the win3540 application program, double-click the “Rochelle win3540” icon on the computer desktop, or click on the Windows Start button, then select Run and type in Rochelle win3540.

The first time you run the program, you will see the following screen:

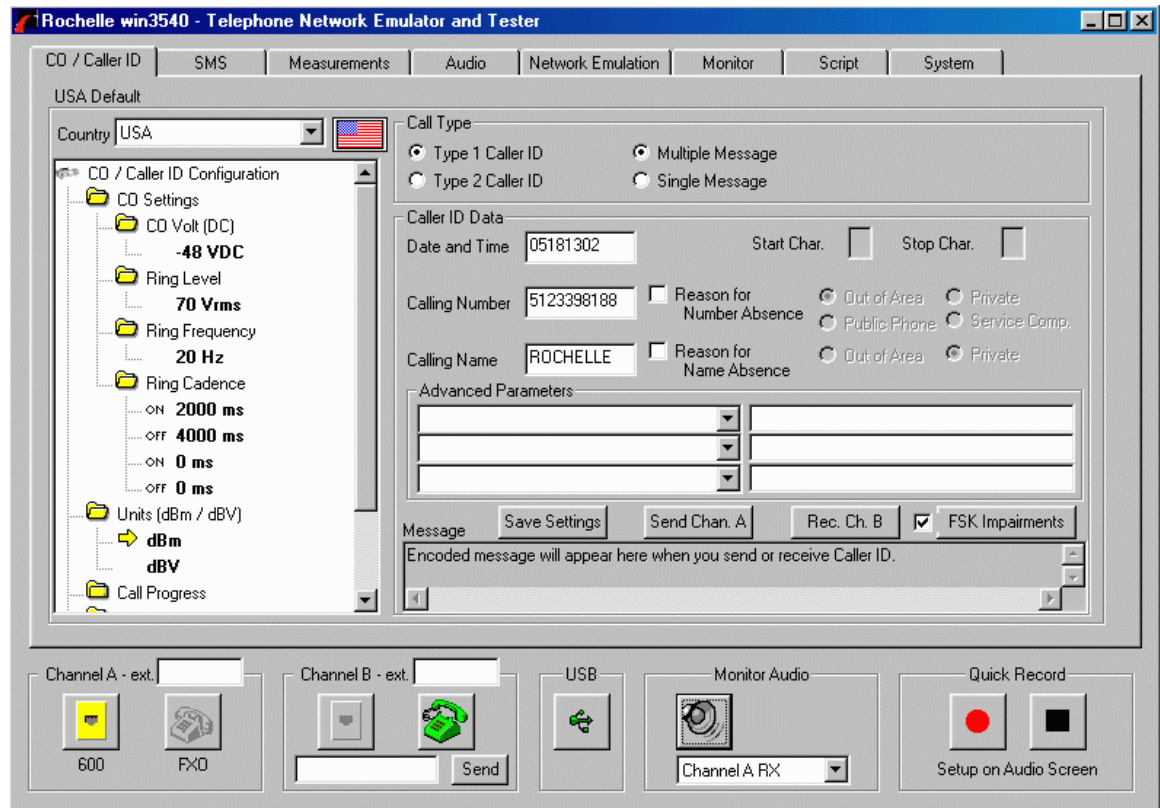


Once the Model 3540 completes its initialization, you will see the CO /Caller ID Setup screen on the following page and will be ready to use your Model.

Note: The Model 3540 initially defaults to Australia as the country. Set the **Country** option appropriately. The Model 3540 will then default to the selected country.

CO / Caller ID Configuration

The Model 3540 software defaults to the following **CO / Caller ID Configuration** screen:



CO Setup Screen

Note there are eight tabs at the top of the screen. These tabs represent the primary functions of the Model 3540 and will be discussed below in greater detail.

Note there are five groups of icons at the bottom of the screen. These groups of icons represent configurations that are common to all Model 3540 functions. These icons remain visible at all times. Following is a description of each configuration:

Channel A and Channel B

FXS: Click on the Channel A or B FXS icon to select FXS (Central Office), and to set the source impedance as **600** Ohms  or **CTR21** .

FXO: Click on the Channel A or B FXO icon to select FXO (Terminal Equipment) and go on-hook  or off-hook . If the FXO port is off-hook, you may enter a number and click . **Note:** The FXO impedance is fixed as 600 Ohms.

Handset Emulation Option: You will see the  icon if your Model 3540 is configured with the Handset Emulation option on either or both FXO channels. See **Appendix 2: Options** for more information on the Handset Emulation Option.

USB Port

The **USB Port** icons indicate the status of the USB connection to the host computer.

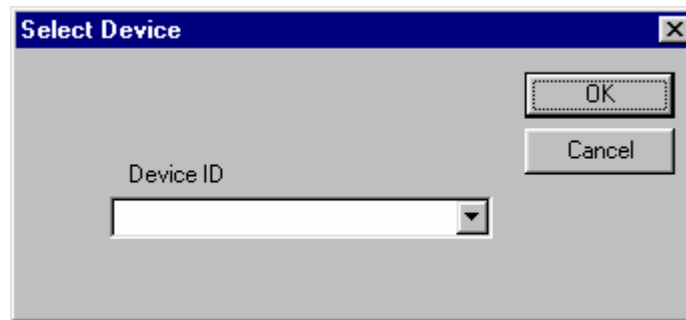


USB Port Active



USB Port Inactive

Clicking on either icon will bring up a screen that lists of all Model 3540's that are connected to the USB port. Click OK to connect to the Model 3540 listed.



Device ID Screen

Speaker

The **Speaker** icons indicate the status of the front panel speaker and headphone jack. Click on the speaker icon to mute and un-mute the speaker.



Speaker On



Speaker Off

Click on the pull-down menu to change the source of the audio for the speaker.



Monitor Audio Screen

Quick Record

Quick Record allows you to quickly record audio from any Model 3540 screen.



Click the button to start recording to the file specified under the **Audio** function tab.

Recording will stop after the duration specified under the **Audio** function tab, or Click the



button to stop recording earlier.

See more information under the **Audio** function tab description.

Function Tabs

There are seven function tabs in the Model 3540. These functions are discussed in detail on the following pages.

CO / Caller ID Config.	Allows setup of the Central Office simulator (and Caller ID)
SMS	Allows setup of the SMS function
Measurements	Allows access to the test and measurement functions
Audio	Allows recording and/or playback of audio
Network Emulation	Allows analog network emulation between channels A & B
Monitor	Allows monitoring of key Model 3540 events
Script	Allows loading, editing, running, and saving of scripts
System	Shows the Model 3540 system configuration

CO / Caller ID Setup

The **CO / Caller ID Setup** function tab allows configuration from the following screen of the Model 3540's internal Central Office (CO) simulator and Caller ID generator:

The screenshot displays the 'CO / Caller ID Setup' window. At the top, a tab bar shows 'CO / Caller ID' as the active tab. Below the tab bar, the 'Country' is set to 'Australia'. A directory tree on the left shows the following structure: 'Caller ID Configuration' (expanded) contains 'CO Settings' (expanded), 'Ring Level' (expanded), 'Ring Frequency' (expanded), 'Ring Cadence' (expanded), 'Units (dBm / dBV)' (expanded), and 'Call Progress' (expanded). The 'CO Settings' folder contains 'CO Volt (DC)' (-48 VDC), 'Ring Level' (75 Vrms), 'Ring Frequency' (25 Hz), 'Ring Cadence' (ON 400 ms, OFF 200 ms, ON 400 ms, OFF 2000 ms), 'Units (dBm / dBV)' (dBm, dBV), and 'Call Progress' (Alert Tone (CAS), Tone 1 Freq (2130 Hz), Tone 1 Level). The main configuration area includes 'Call Type' (Type 1 Caller ID, Multiple Message), 'Caller ID Data' (Date and Time: 05010704, Calling Number: 0000000000, Calling Name: JAMES T KIRK), and 'Advanced Parameters' (Reason for Number Absence, Reason for Name Absence, Out of Area, Private, Public Phone, Service Comp.). At the bottom, there are buttons for 'Save Settings', 'Send Chan. A', 'Rec. Ch. B', and 'FSK Impairments', along with a message display area.

CO / Caller ID Function

The **Country** pull-down menu allows selection of countries that are pre-defined in the Model 3540. Selecting a specific country will set all CO and Caller ID configurations accordingly. The last option under the pull-down menu is **User-Defined** which lets you save and/or load a file with user-defined CO and Caller ID settings.

The **CO / Caller ID Configuration** directory tree allows viewing and modifying of specific CO and Caller ID parameters. Click the Folder icons  to access the parameters (the above screen shows the folders opened). For directory items with an Arrow icon , double click on the desired selection. Type in the desired value for other directory items. Appropriate limits may apply to the range of input values.

Note: **Units of Measurement** allows changing the **Units** from **dBm** to **dBV** and back. These units are then used in all Model 3540 functions.

dBm means "dBm across a termination impedance of 600 Ohms." Use dBm when channel A or B is set to FXS: 600 Ohms or when channel A or B is set to FXO.

dBV means "dB in relation to 1 Vrms" and is not dependant on termination impedance. Use dBV when channel A or B is set to FXS: CTR21.

Changes in the directory tree will immediately affect CO / Caller ID settings, though to save those settings for future use, click the **Save Settings** button, and create a **User-Defined** .xml file. The country-specific .xml files are read only and cannot be changed.

For the **Caller ID Type** section:

Select Type I or Type II Caller ID
Select Single Message or Multiple Message

For the **Caller ID Data** section:

Enter the appropriate Date and Time.

Enter the appropriate Calling Number: You may also check the Reason for Number Absence box and select the appropriate reason for no number.

Enter the appropriate Calling Name: You may also check the Reason for Number Absence box and select the appropriate reason for no name.

For DTMF Caller ID, enter the appropriate Start Character and Stop Character.

For the **Advanced Parameters** section, the parameters vary depending on the country and the type of Caller ID that is selected. Select the appropriate parameter from the pull-down menus. Enter an appropriate value to the right of each parameter. The parameters and their values are based on appropriate international and national Caller ID standards.

The **Message** box displays the characters that are generated by the Model 3540 after clicking the **Send Chan A** or **Send Chan B** button. Characters displayed within angle brackets, e.g. <5E>, are hex values. Other characters are alphanumeric.

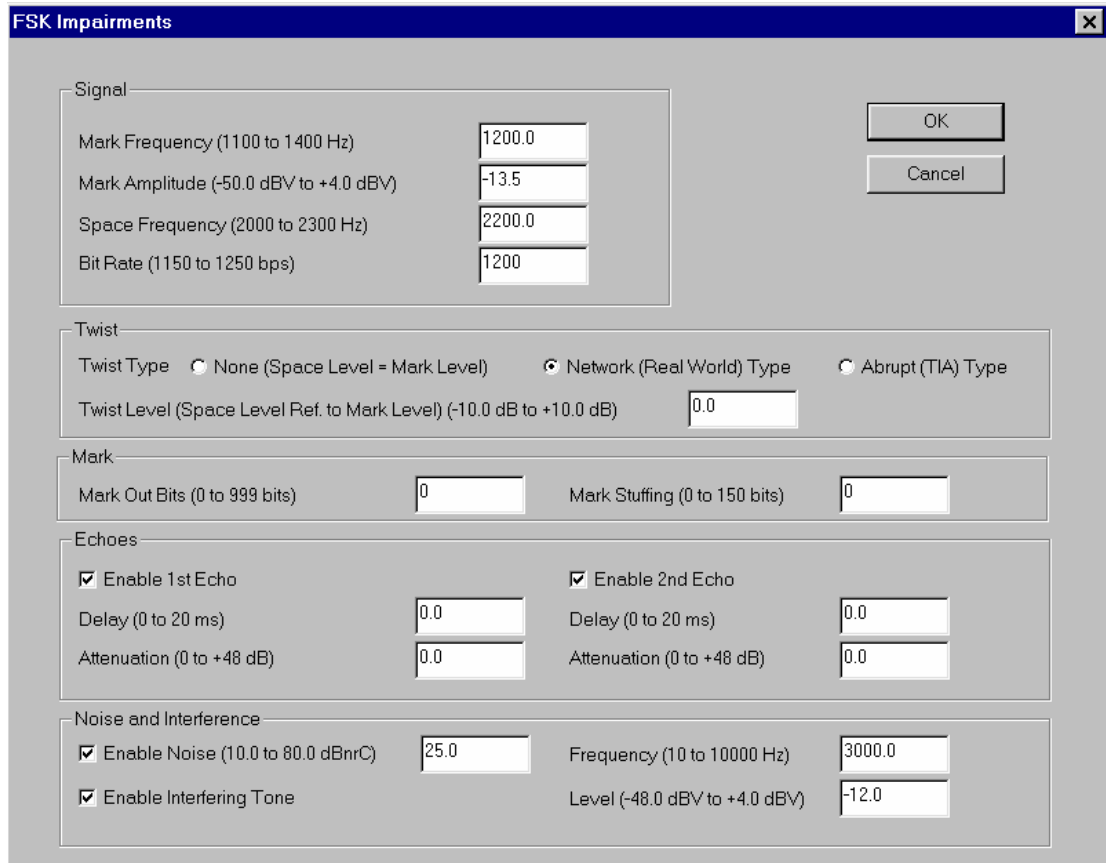
Click the **Save Settings** button to save the displayed CO and Caller ID configuration to a User-Defined file. The User-Defined file is then accessible under the country menu.

If the channel is configured as **FXS**, click the **Send Channel A** or **Send Channel B** button to send a Caller ID signal to the appropriate channel with the configuration specified on the **CO Setup** screen.

If the channel is configured as **FXO**, click the **Receive Channel A** or **Receive Channel B** button to receive Caller ID signal on the appropriate channel with the configuration specified on the **CO Setup** screen.

You will see a **Script Executing** screen while the Caller ID message is transmitted. The software converts the information on the **CO Setup** screen to a Rochelle script and then executes the script. Go to the **Script** function tab to look at the executed script.

If you select a country with **FSK** Caller ID, then checking the **FSK Impairments** box and clicking the **FSK Impairments** button will bring up the following screen.



The FSK Impairments dialog box is divided into several sections for configuring signal impairments. The 'Signal' section at the top contains four input fields: Mark Frequency (1100 to 1400 Hz) set to 1200.0, Mark Amplitude (-50.0 dBV to +4.0 dBV) set to -13.5, Space Frequency (2000 to 2300 Hz) set to 2200.0, and Bit Rate (1150 to 1250 bps) set to 1200. To the right of these fields are 'OK' and 'Cancel' buttons. Below the Signal section is the 'Twist' section, which includes radio buttons for 'None (Space Level = Mark Level)', 'Network (Real World) Type' (which is selected), and 'Abrupt (TIA) Type'. It also has a 'Twist Level (Space Level Ref. to Mark Level) (-10.0 dB to +10.0 dB)' input field set to 0.0. The 'Mark' section follows, with 'Mark Out Bits (0 to 999 bits)' and 'Mark Stuffing (0 to 150 bits)' both set to 0. The 'Echoes' section contains two columns of settings, each with a checked 'Enable' checkbox, a 'Delay (0 to 20 ms)' field set to 0.0, and an 'Attenuation (0 to +48 dB)' field set to 0.0. The 'Noise and Interference' section at the bottom has two checked checkboxes: 'Enable Noise (10.0 to 80.0 dBnC)' with a value of 25.0, and 'Enable Interfering Tone' with a 'Frequency (10 to 10000 Hz)' set to 3000.0 and a 'Level (-48.0 dBV to +4.0 dBV)' set to -12.0.

FSK Impairments Screen

Select and enter the appropriate FSK impairments.

Note: Twist type refers to three methods of defining twist. See the appropriate telephony standard for more information (or use the default twist setting).

Note: Delay and Attenuation will create a copy of the transmitted FSK signal that is shifted in time and amplitude. The delay of the second Echo is in reference to the first.

Click on the **OK** button to accept the changes and return to the previous screen, or click on the **Cancel** button to return to the previous screen without accepting the changes.

DTMF Impairments

If you select a country with **DTMF** Caller ID, then checking the **DTMF Impairments** box and clicking the **DTMF Impairments** button will bring up a screen (not shown) that allows you to change the levels of the DTMF tones.

Enter the levels for the upper lower tones of each DTMF digit. Enter the deviation in Hertz for each DTMF digit from its standard value.

Click on the **OK** button to accept the changes and return to the previous screen, or click on the **Cancel** button to return to the previous screen without accepting the changes.

Click **Reset to Defaults** to reset the DTMF levels to their default values.

SMS

The **SMS** function tab allows configuration of the SMS function from the following screen:

SMS Function Tab

Note: All of the CO and Caller ID configurations from the **CO/ Caller ID Configuration** screen are still in effect while sending or receiving SMS.

The **Country** pull-down menu allows selection of countries that are predefined for SMS in the Model 3540. Selecting a specific country will set all SMS configurations accordingly, but will **not** change the country-specific configurations in the CO/Caller ID screen.

Select **Send Messages** or **Receive Messages** to send or receive SMS messages.

For the **Country Setup** section:

Enter the appropriate number in the **Number SC to TE message** box from the **SC** (SMS Service Center) to the **TE** (Terminal Equipment).

Enter the appropriate number in the **Number TE to SC message** box from the **TE** (Terminal Equipment) to the **SC** (SMS Service Center).

Click the **Set Numbers as Defaults** button to save the Country Setup numbers as the defaults for the SMS country selected.

For the **Service Center (SC)** section:

Enter the appropriate Type of address

Enter the appropriate Sender Number. This number is used instead of the Calling Number selected on the **CO Setup** screen.

Enter the appropriate **Sub** or Sub-address for a Short Message (SM) to a Short Message Entity (SME) connected to the line.

Enter the appropriate Delivery Mode. Acceptable values are 0 to 9 as follows:

- 0: The TE will accept the call, but return an error message
- 1: The TE will accept the call, but **not** return an error message
- 2-9: The TE will not accept the call

For the **Timestamp** section, enter the appropriate time and date stamp.

For the **Advanced Parameters** section, the parameters vary depending on the country and the type of Caller ID that is selected. Select the appropriate parameter from the pull-down menus. Enter an appropriate value to the right of each parameter. The parameters and their values are based on appropriate international and national SMS standards.

The SMS **Message** box displays the characters that are generated by the Model 3540 after pressing the **Send Channel A** or **Send Channel B** button. Characters displayed within angle brackets, e.g. <5E>, are hex values; other characters are alphanumeric.

The **Chars** box displays the number of characters in the SMS Message (and associated SMS Header bits). The number will be displayed in **red** if the total number of characters exceeds 255 Octets.

For the **Timing** section, the parameters vary depending on whether Sending Messages or Receiving Messages is selected. The parameters also vary depending on the country that is selected. Enter an appropriate value to the right of each parameter.

See **Appendix: SMS Parameters** in this manual for a list of SMS parameters and their permissible values.

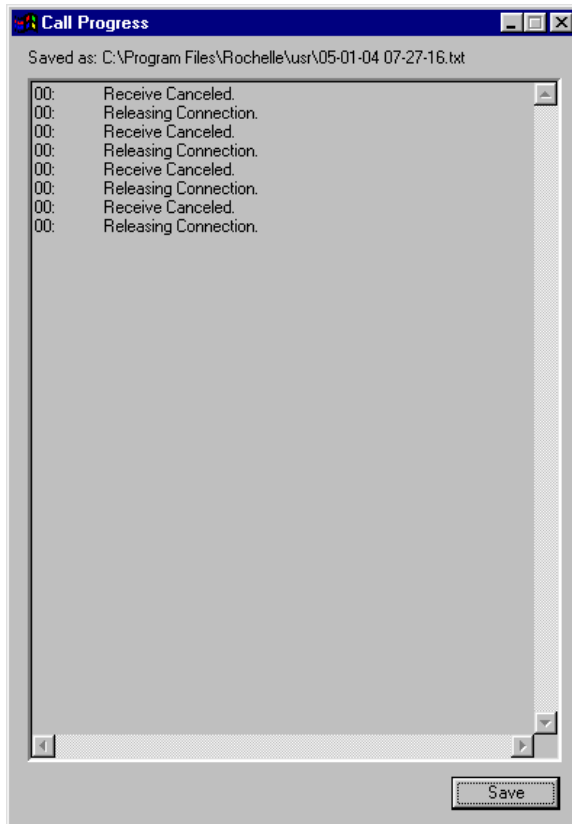
Click the **Send Channel A** or **Send Channel B** button to send an SMS signal to the appropriate channel with the configuration specified on the **CO Setup** screen.

Click the **Receive Channel A** or **Receive Channel B** button to receive an SMS signal to the appropriate channel with the configuration specified on the **CO Setup** screen.

Check the **FSK Impairments** box and click the **FSK Impairments** button to impair the SMS signal generated by the Model 3540. See the section on FSK Impairments under the **CO / Caller ID Setup** function tab for more information on FSK Impairments.

You will see a **Script Executing** screen while the Caller ID message is transmitted. The Model 3540 converts the information on the **CO Setup** screen to a Rochelle script and then executes the script. Go to the **Script** function tab to look at the executed script.

Click the Call Progress button to display the **Call Progress** screen:



Call Progress Screen

The **Call Progress** screen displays the sequence of events during the SMS transmission.

The left-hand column lists timestamps in milliseconds for each event, where 0000 is the time the Send Channel A or Send Channel B button was pressed.

The right-hand column displays the event that corresponds to the timestamp. If the event is a recognized SMS message, then the type of message is displayed. If the event is DTMF or FSK data, the <hex> and alphanumeric data is displayed.

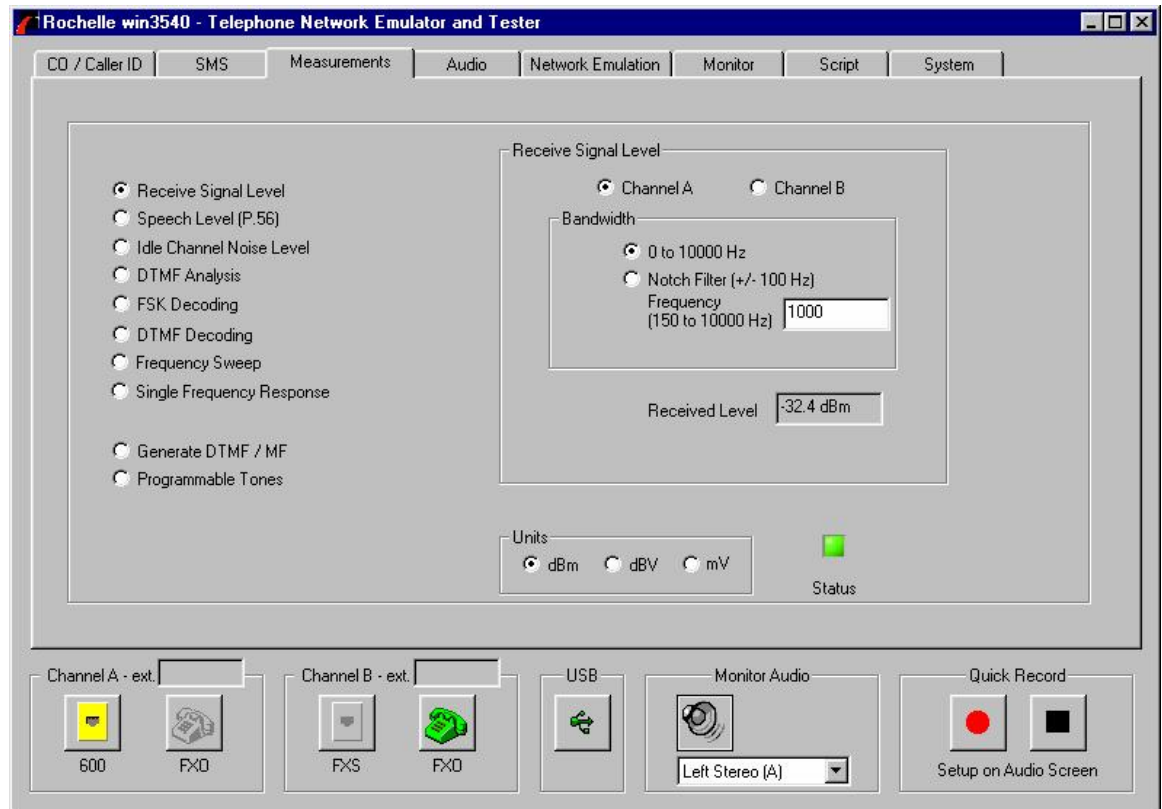
Click the **Save** button to save the call progress to a default file based on the date and time. The file name will then appear at the top of the **Call Progress** screen.

Click on the **X** in the title bar to close the **Call Progress** screen

Measurements

The **Measurements** function tab allows access to the test and measurement functions in the Model 3540. Each measurement screen displays a set of radio buttons for all the measurements on the left side of the screen. Each screen displays the selected measurement on the right side of the screen.

Receive Signal Level



Measurements Function Tab with Receive Signal Level

This measurement calculates the RMS value of all signals within the bandwidth selected and displays the results in dBm.

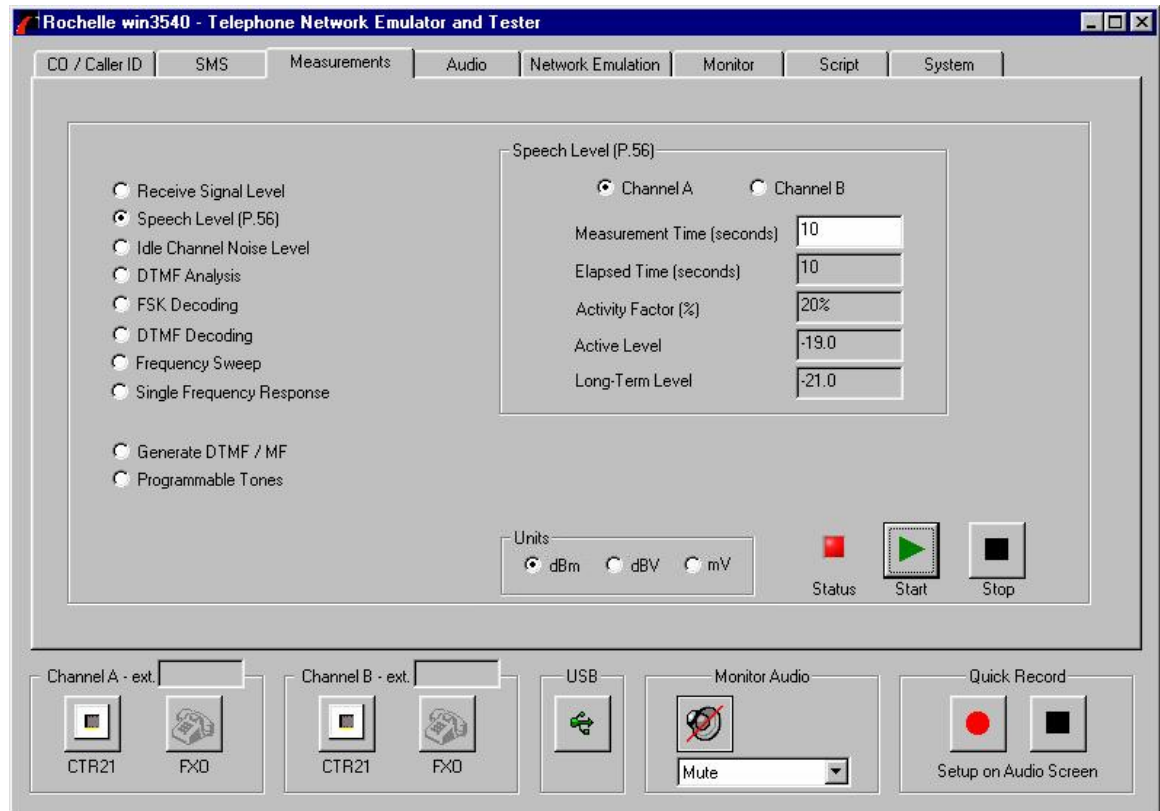
Select Channel A or Channel B for the measurement channel.

Select 0 to 10000 Hz or Notch Filter for the measurement bandwidth. If you select Notch Filter, then enter the desired center frequency of the filter. Note the 3 dB points of the Notch filter are ± 125 Hz.

The **Units** of Measurement are based on the Country configuration. You may also select **dBm** (in relation to 600 Ohms), **dBV** or **mV** to display readings accordingly.

The  LED shows the measurement is continuous.

Speech Level



Speech Level Screen

This measurement calculates the Activity Level, Active Level, and Long-Term Level as per the ITU P.56 specification and displays the results with the appropriate units.

Select Channel A or Channel B for the measurement channel.

Enter the duration (in seconds) of the measurement.

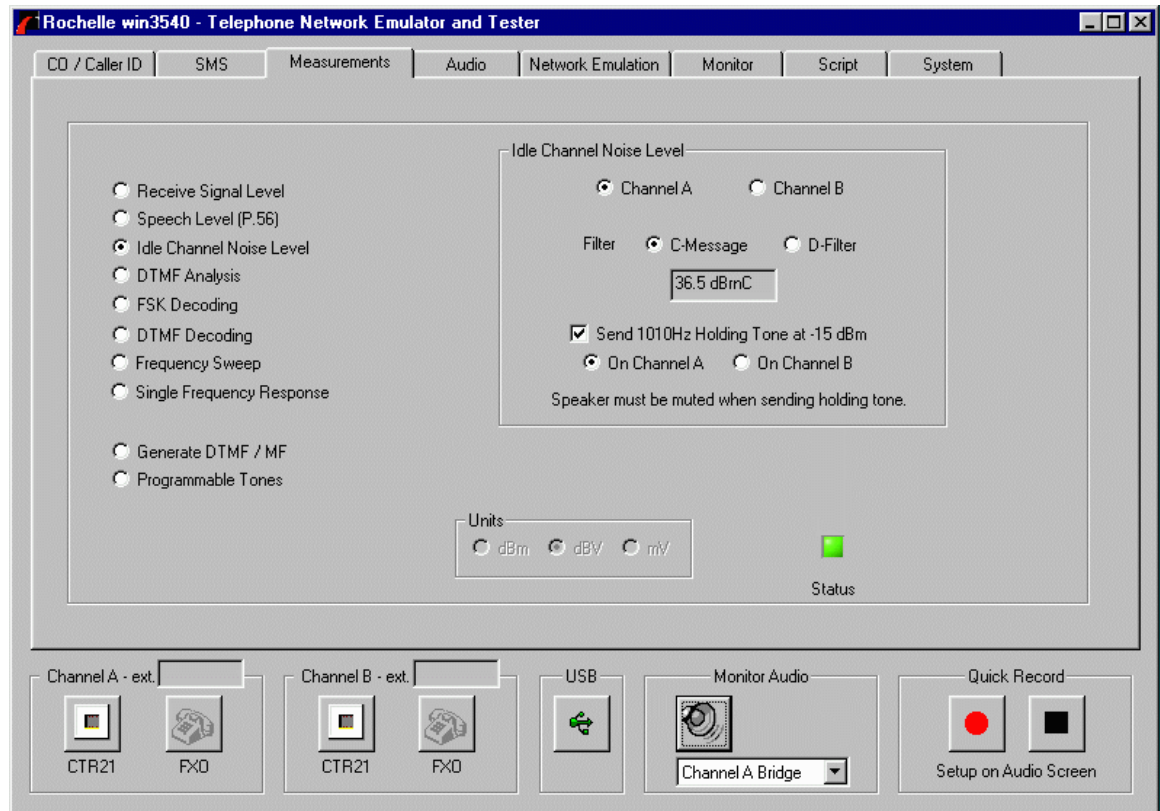
The **Units** of Measurement are based on the Country configuration. You may also select **dBm** (in relation to 600 Ohms), **dBV** or **mV** to display readings accordingly.

Click  to start the measurement. The  LED shows the measurement is in progress.

Click  to stop the measurement. The  LED shows the measurement has stopped.

Once the measurement time has elapsed or the measurement is stopped, the screen will show: the % of the time duration that speech was detected, the short-term speech level, and the average speech level over the duration of the measurement.

Idle Channel Noise Level



Idle Channel Noise Screen

This measurement calculates the Idle Channel Noise in accordance with IEEE Standard 743-1995 and displays the results with the appropriate units.

Select Channel A or Channel B for the measurement channel.

Enter C-Message or D Filter as the noise filter type.

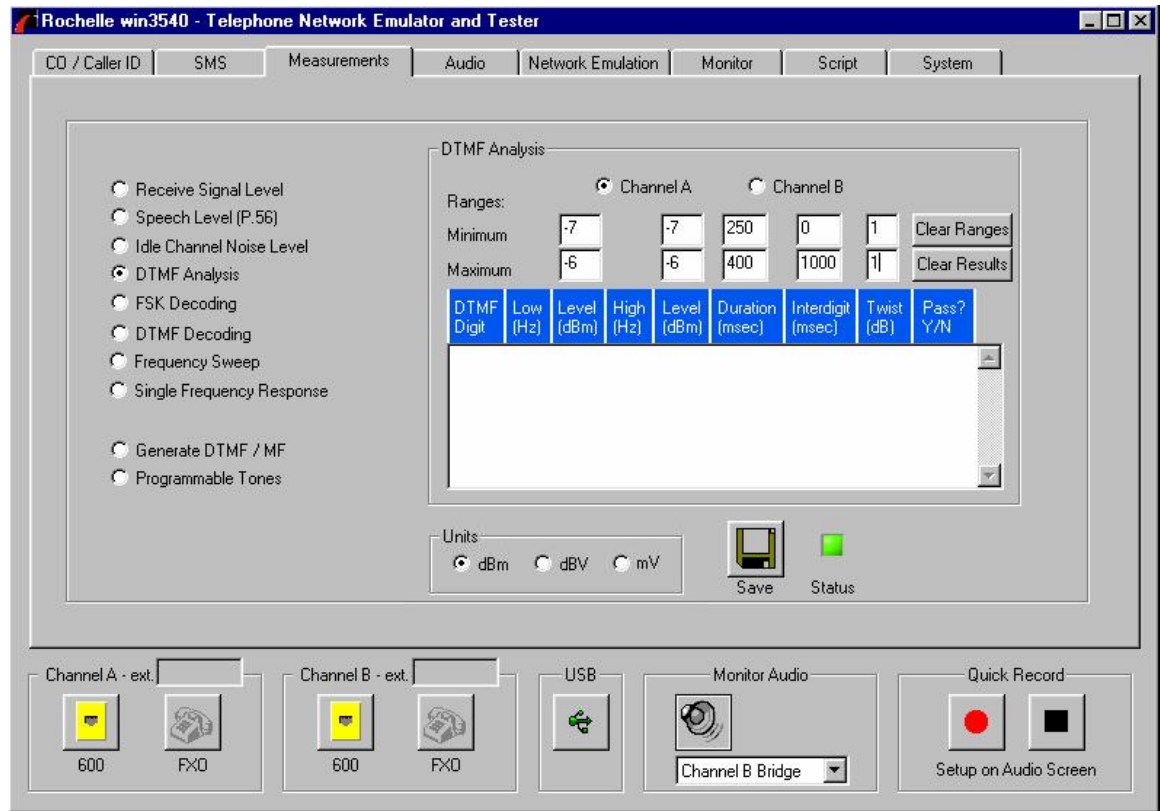
Check the Enable 1010 Hz Holding Tone box and on Channel A or on Channel B to transmit a Holding Tone while measuring Noise. The Noise measurement will filter out the 1010 Hz filter before calculating the Noise level.

Note: The speaker must be muted when measuring Noise with Holding Tone.

The **Units** of Measurement are **dBrnC** if the **C-message** filter is selected, or **dBrnD** if the **D-filter** is selected

The  LED shows the measurement is continuous.

DTMF Analysis



DTMF Analysis Screen

This measurement decodes and analyzes the frequency, level, duration, and twist of received DTMF digits. A Pass/Fail condition for each analyzed digit is also determined.

Select **Channel A** or **Channel B** for the measurement channel. Enter the appropriate **Minimum** and **Maximum** values for level, duration, timing, and twist. The following table displays the DTMF analysis results:

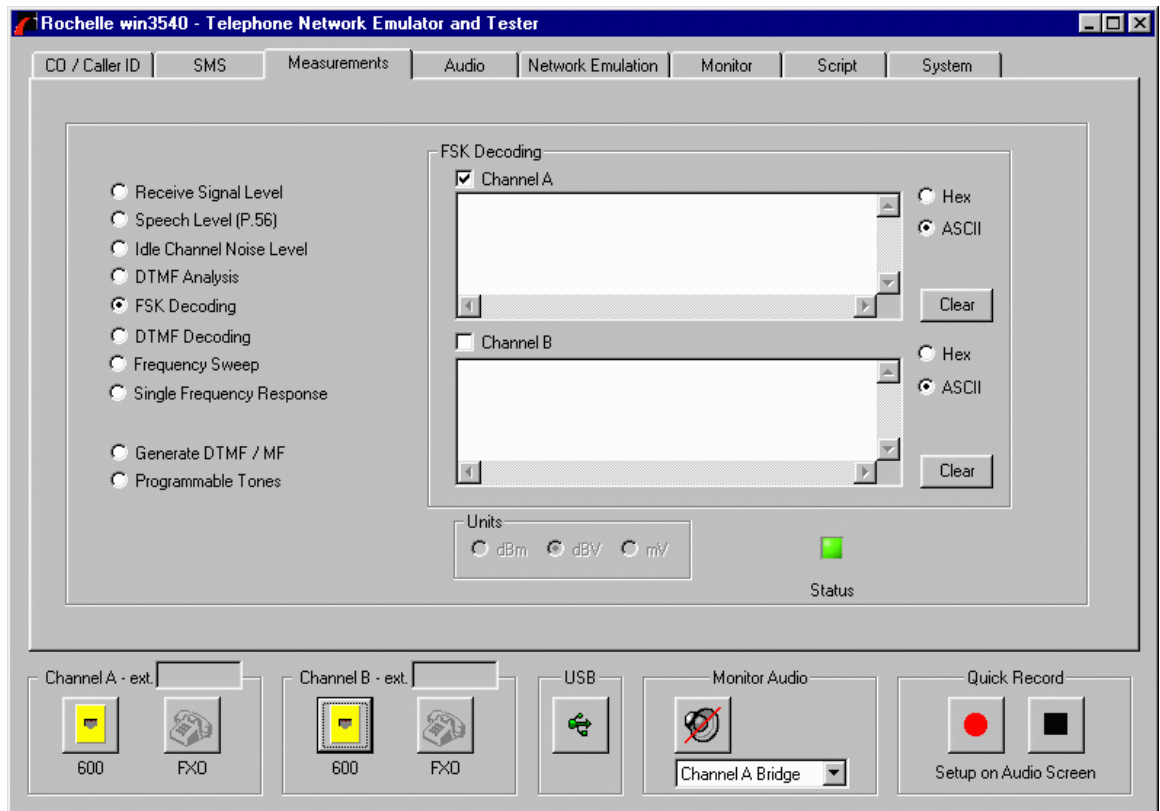
DTMF Digit	The received DTMF digit
Low Freq	The frequency of the low tone in the DTMF digit
Level	The level of the low tone in the DTMF digit
High Freq	The frequency of the high tone in the DTMF digit
Level	The level of the high tone in the DTMF digit
Duration	The duration of the DTMF digit
Interdigit	The time in milliseconds since the last DTMF digit. <i>Note: Interdigit time > 4000 mS will be displayed as > 4000.</i>
Pass/Fail	The Pass/Fail condition for the DTFM digit based on the Min/Max values set above the table

The measurement is updated once per second. The Status box shows the progress.

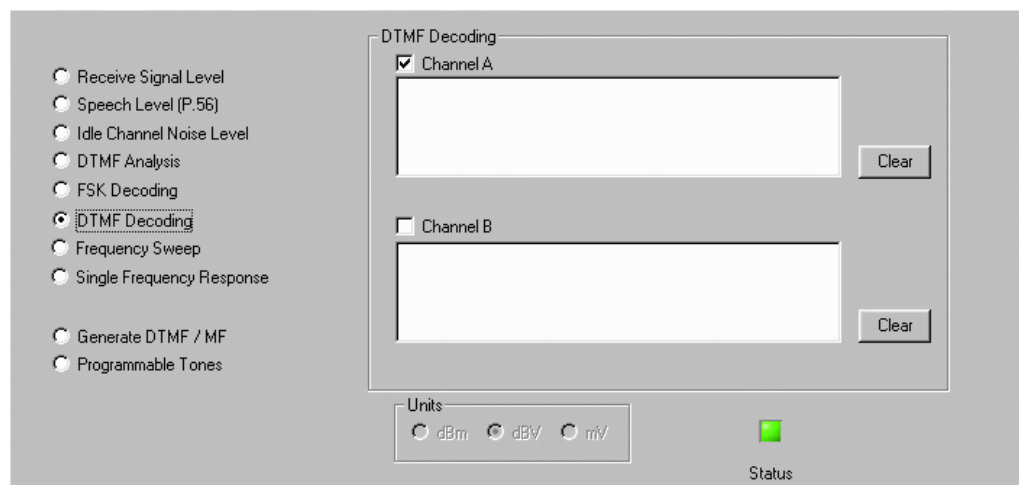
The **Units** of Measurement are based on the Country configuration. You may also select **dBm** (in relation to 600 Ohms), **dBV** or **mV** to display readings accordingly.

The  LED shows the measurement is continuous. Click  to save the DTMF analysis to a file.

FSK and DTMF Decoding



FSK Decoding Screen



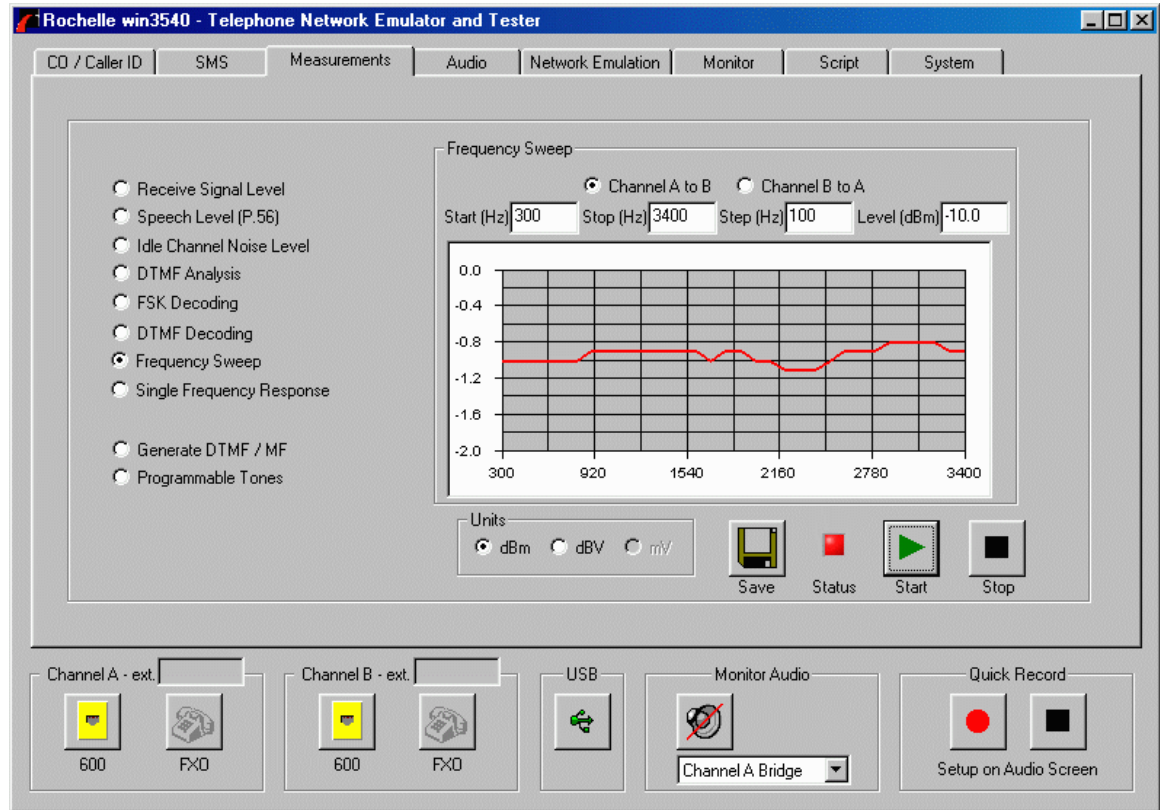
DTMF Decoding Screen

These measurements decode and display the incoming FSK data or DTMF digits.

Select Channel A or Channel B for the measurement channel. For FSK Decode, Select Hex or ASCII data display.

Click the **Clear** button to clear the results boxes. The  LED shows the measurements are continuous.

Frequency Sweep



Frequency Sweep

This function generates a sequence of reference tones on one channel and measures the receive level on the other channel.

Select Channel A to Channel B or select Channel B to Channel A.

Enter the **Start** and **Stop** frequency of the transmitted tone. Enter the **Step** size between tones. Enter the **Level** of the transmitted tone.

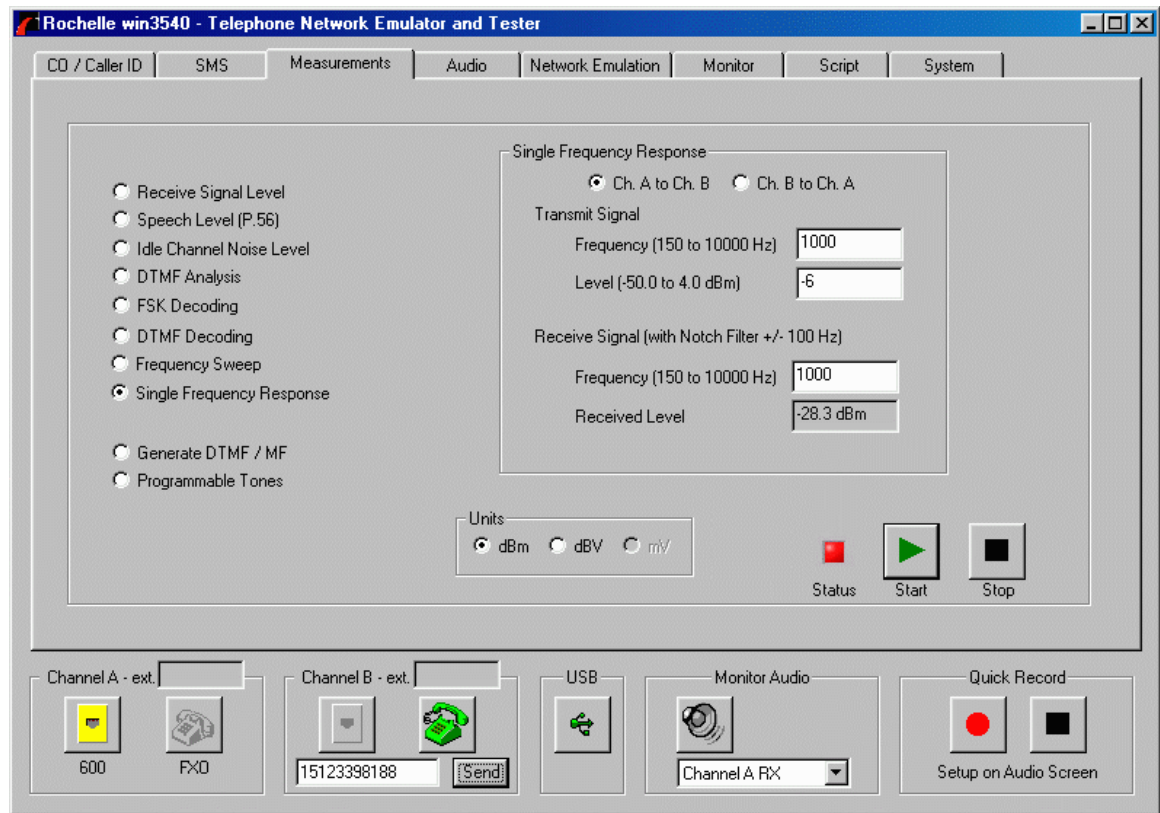
The **Units** of Measurement are based on the Country configuration. You may also select **dBm** (in relation to 600 Ohms) or **dBV** (but not **mV**) to display readings accordingly.

Click  to start the measurement. The  LED shows the measurement is in progress.

Click  to stop the measurement. The  LED shows the measurement has stopped.

Once the sweep has completed (or the measurement has been stopped), the screen will display a graph of the relative difference between the transmit and receive signal in dB. Move the cursor over the trace in the graph to see actual measured values.

Single Frequency Response



Single Frequency Response

The function generates a reference tone on one channel and measures the receive level on the other channel.

Select Channel A to Channel B or select Channel B to Channel A.

Enter the Frequency and Level of the transmitted tone.

Enter the desired center frequency of the filter. Note the 3-dB points of the Notch filter are ± 125 Hz, and the 10-dB points ± 500 Hz

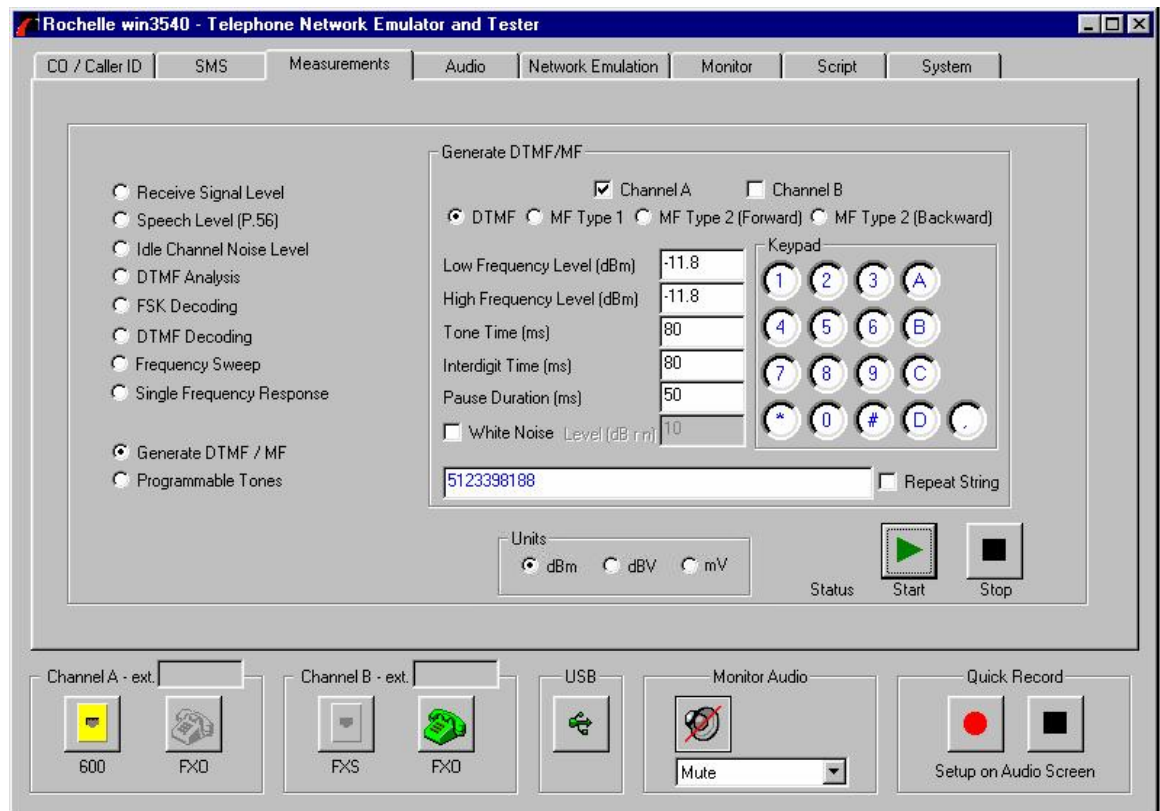
Note: You may set the receive frequency different than the transmit frequency.

The **Units** of Measurement are based on the Country configuration. You may also select **dBm** (in relation to 600 Ohms) or **dBV** (but not **mV**) to display readings accordingly.

Click  to start the measurement. The  LED shows the measurement is in progress.

Click  to stop the measurement. The  LED shows the measurement has stopped.

Generate DTMF or MF



Generate DTMF of MF Screen

This function generates DTMF or MF tones.

Select Channel A or Channel B for the generation channel.

Select DTMF, MF Type 1, MF Type 2 (Forward), or MF Type 2 (Backwards)

Enter the appropriate levels for the high and low tone of each digit.

Enter the appropriate digit duration, interdigit timing, and pause duration.

Check White Noise to generate noise. Enter the appropriate level noise.

Click on the keypad on the screen, or enter numbers in the message box.

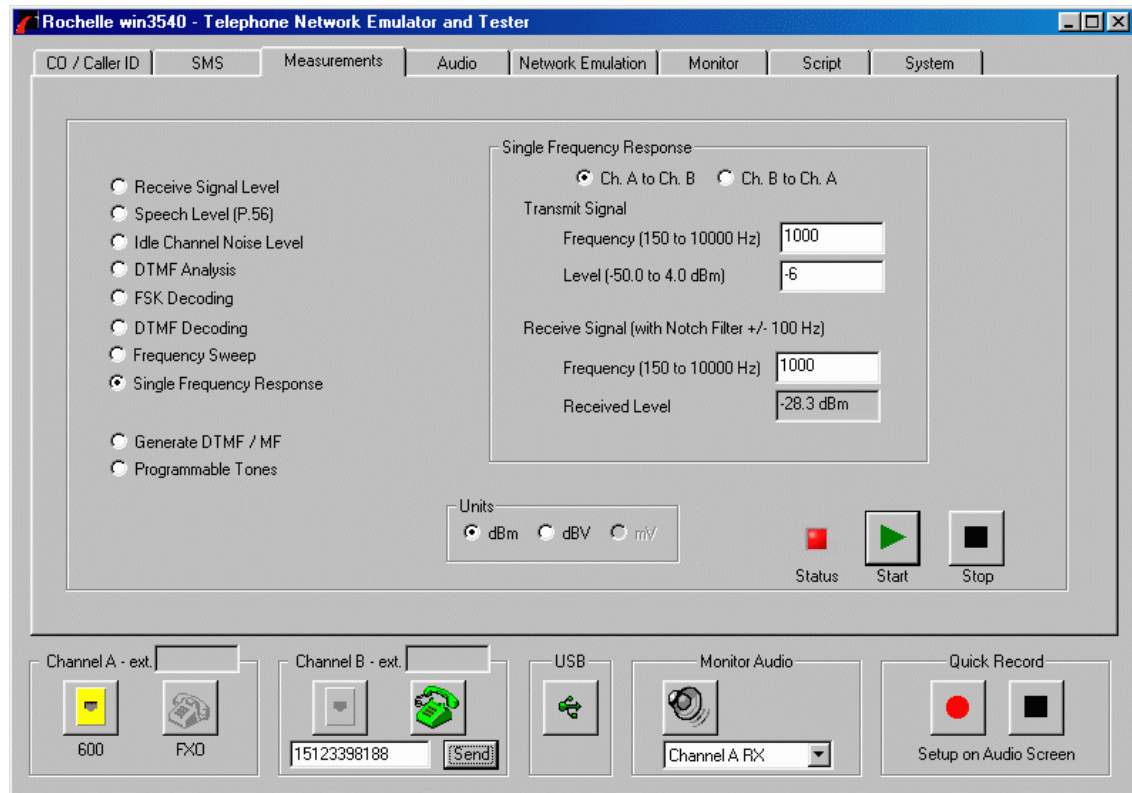
Check Repeat String to repeat the numbers in the message box

The **Units** of Measurement are based on the Country configuration. You may also select **dBm** (in relation to 600 Ohms), **dBV** or **mV** to display readings accordingly.

Click  to send DTMF or MF. The  LED shows sending is in progress.

Click  to stop sending. The  LED shows sending has stopped.

Programmable Tones



Programmable Tones Screen

This function generates tones from either or both of two internal tone generators.

Select Channel A or Channel B for the generation channel.

Check the Tone Generator 1 box to generate the first tone. Enter the appropriate frequency and level for the first tone. Check the Tone Generator 2 box to generate the second tone. Enter the appropriate frequency and level for the second tone.

Check the White Noise box to generate noise. Enter the appropriate level for the noise.

Select Tone 1 + Tone 2 to sum the two tones. Select Tone 1 x Tones to modulate tone one with tone two.

Check the Duration box to set the duration of the tones. Enter the appropriate duration in milliseconds.

The **Units** of Measurement are based on the Country configuration. You may also select **dBm** (in relation to 600 Ohms), **dBV** or **mV** to display readings accordingly.

Click  to start the measurement. The  LED shows the measurement is in progress.

Click  to stop the measurement. The  LED shows the measurement has stopped.

Audio

Audio Function Tab

The **Audio Record** function permits recording of audio on either Channel A or Channel B, and saving the audio in a .wav file on the host computer.

The **Audio Playback** function uses the sound card in the host computer to generate a .wav file that is then played over Channel A or Channel B of the Model 3540.

To **Record** audio, select the source for the Left Stereo Channel, and the source for the Right Stereo Channel. Select the appropriate sampling rate, where the sampling rate is twice the highest frequency of interest.

Enter the appropriate name for the audio file, or click on the Browse button to locate a directory and file. Enter the appropriate length of the recording.

Press the  button to start recording. The  LED shows recording is in progress.

To **play** audio enter the appropriate name for the audio file, or click on the Browse button to locate a directory and file.

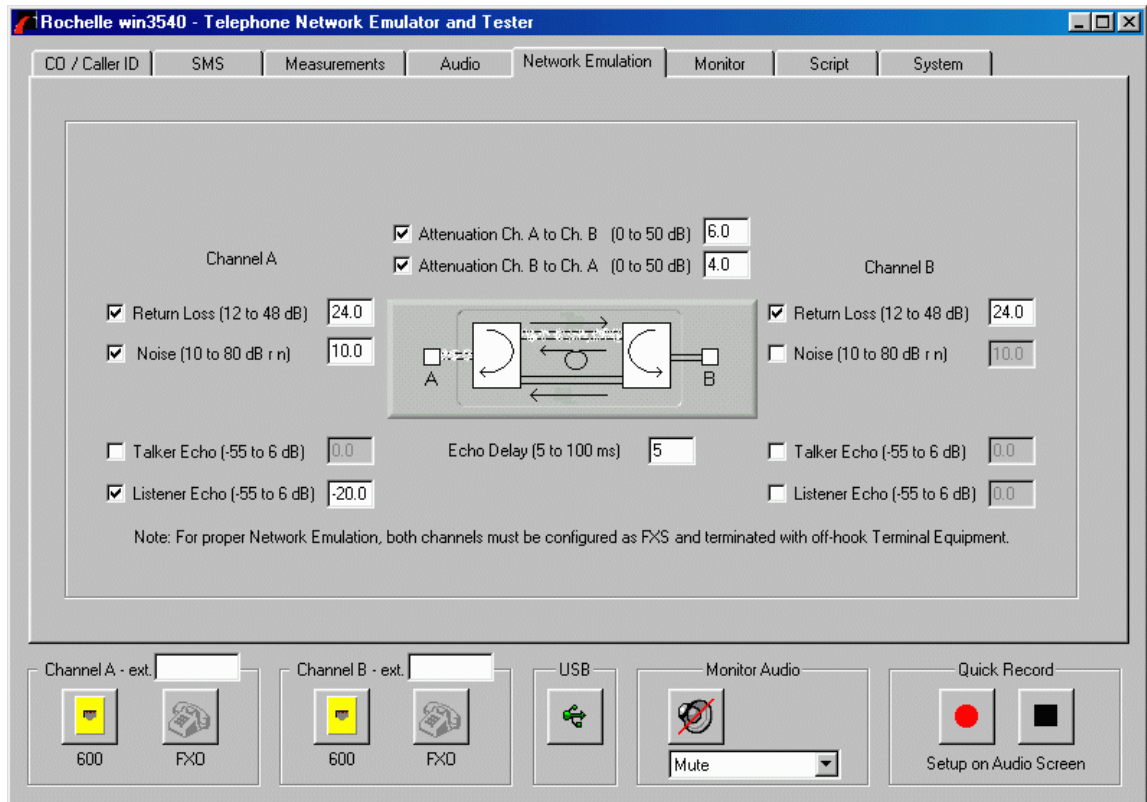
Click Channel A to direct the Left Stereo Channel to the Model 3540 Channel A. Enter the appropriate level of the audio from the Model 3540 Channel A. Click Channel B to direct the Left Stereo Channel to the Model 3540 Channel B. Enter the appropriate level of the audio from the Model 3540 Channel B.

Press the  button to start playing. The  LED shows playback is in progress. Press the  button to stop. The  LED shows playback has stopped.

You may also play audio on one Model 3540 channel and simultaneously record audio on the other Model 3540 channel. Configure the record and playback channels and

press the  button to start. The  LED shows recording and playback is in progress.

Network Emulation



Network Emulation Function Tab

The **Network Emulation** function allows the Model 3540 to act as a four-wire telephone network with the extension numbers defined in the port configurations.

Check the **Attenuation Ch A TX to Ch B RX** or **Attenuation Ch A TX to Ch B RX** box to set the one-way attenuation from one channel to the other. Enter the appropriate value of attenuation. If the box is not checked, then the attenuation will be >50 dB.

Return Loss  is signal reflected back into a channel by an impedance mismatch. Check the **Return Loss** box to set return loss on Channel A or B, and then enter the appropriate value.

Noise  is noise heard on the selected channel. Check the Noise box on channel A or B, and then enter the appropriate value of Noise.

Talker Echo  is echo on the same channel as the transmitted signal. Check the **Talker Echo** box to set the talker echo on Channel A or B, and then enter the appropriate value of talker echo.

Listener Echo  is echo on the opposite channel as the transmitted signal. Check the **Listener Echo** box to set the listener echo on Channel A or B, and then enter the

appropriate value of listener echo. If an **Echo** is selected, then enter the **Echo Delay**. **Note** the same delay applies to all the echoes.

Note: **Network Simulation** is only designed to work with both channels configured as **FXS** and with the same impedance (either **600 Ohms** or **CTR21**). **Network Simulation** is also designed to work with Terminal Equipment (e.g. Modems or telephones) that are off-hook. Using the **Network Simulation** on an unterminated channel or with TE devices that are on-hook may cause "singing echo" between the two channels.

Extension Numbers: Channel A has a default extension number of 101. Channel B has a default extension number of 102. You may change either extension number by typing a new number in the appropriate box.

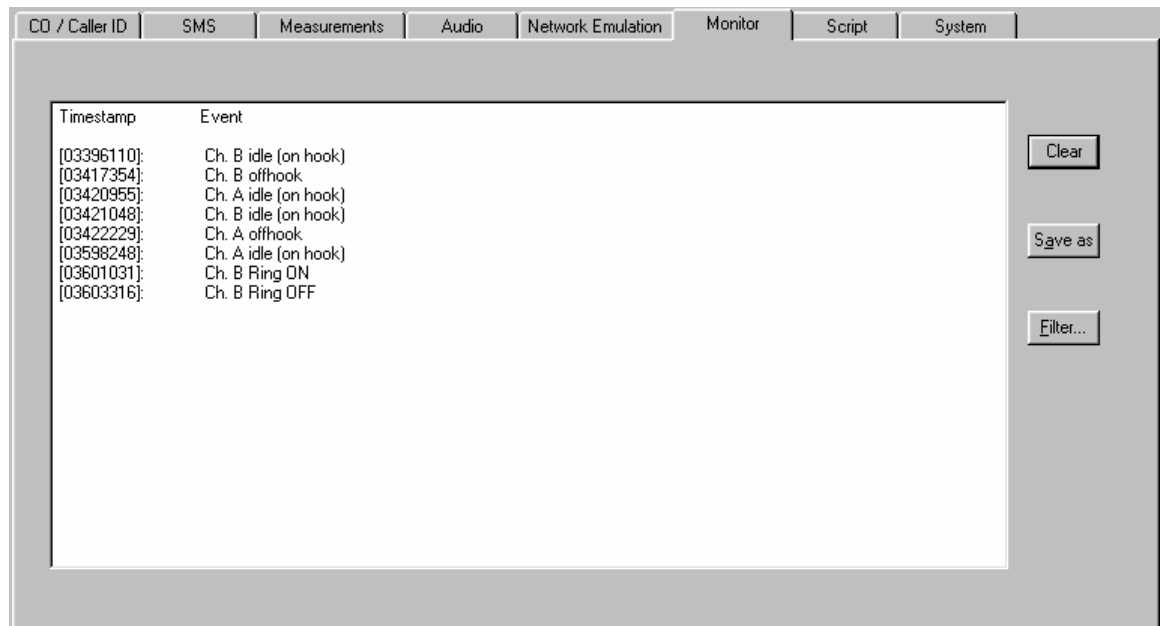
If you connect a telephone to Channel A and another telephone to Channel B, you may dial from channel A to channel B by picking up telephone A and dialing the extension number of telephone B. You may **not** dial from Channel B to Channel A.

An example of using the **Network Emulation** function for testing a telephone set with "Golden Telephone" (a unit that has been tested and calibrated) is as follows:

- Configure the **CO / Caller ID** function tab as desired.
- Set up the **Network Simulation** function tab as desired.
- Connect a "Telephone Under Test" to Channel A and the "Golden Telephone" to Channel B.
- Using the Telephone Under Test, dial the Extension (Ext.) listed for Channel B. The Golden Telephone connected to channel B should now ring. Go off hook with the Golden Telephone and verify it can receive signals from the Telephone Under Test.
- Select different network impairments, and verify the two telephones can still communicate under impaired network condition.

Note: The **Network Simulation** settings are disabled when leaving the Network Simulation screen and before going to any other screen (e.g. Measurements).

Monitor



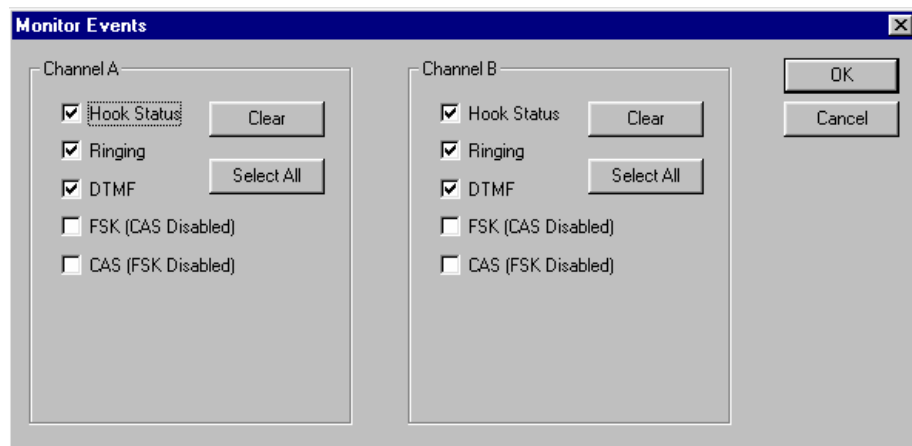
Monitor Function Tab

The Monitor function allows monitoring events in the Model 3540.

Click the Clear button to clear the screen.

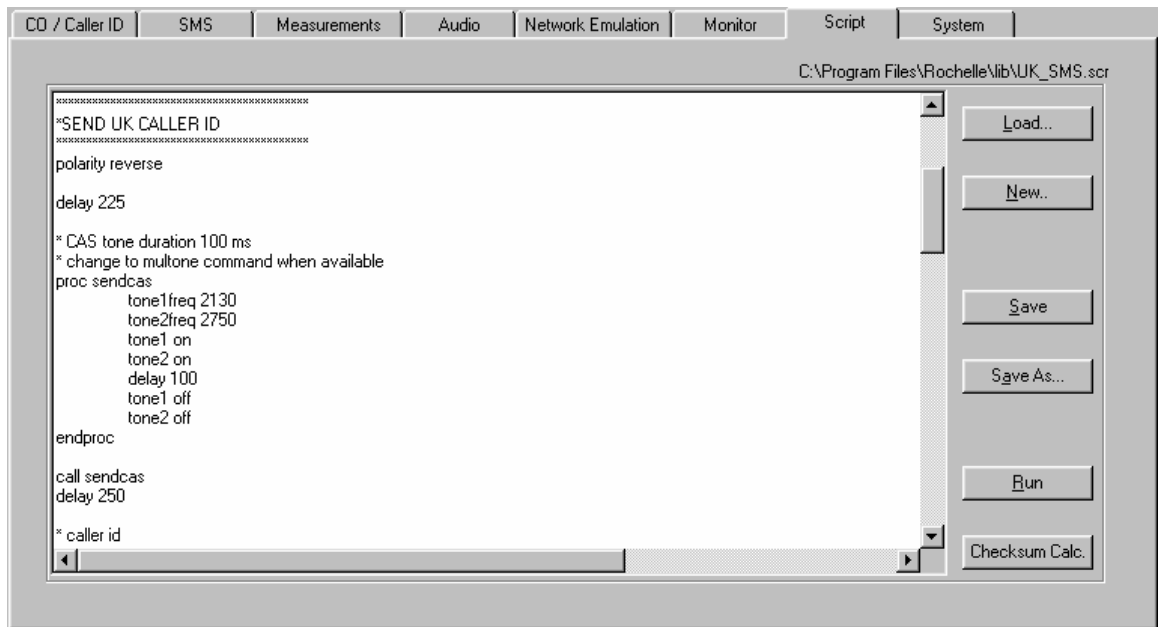
Click the Save As button to save the displayed script with a new file name.

Click the Filter button to filter the monitored events as follows:



Make the appropriate selections and Click the OK button to filter the selected events.

Script



Script Function Tab

The Script function allows loading, editing, running, and saving of Rochelle scripts.

Click the Load button to load an existing script file.

Click the New button to clear the existing screen and create a new script file.

Click the Save button to save the displayed script with the current file name.

Click the Save As button to save the displayed script with a new file name.

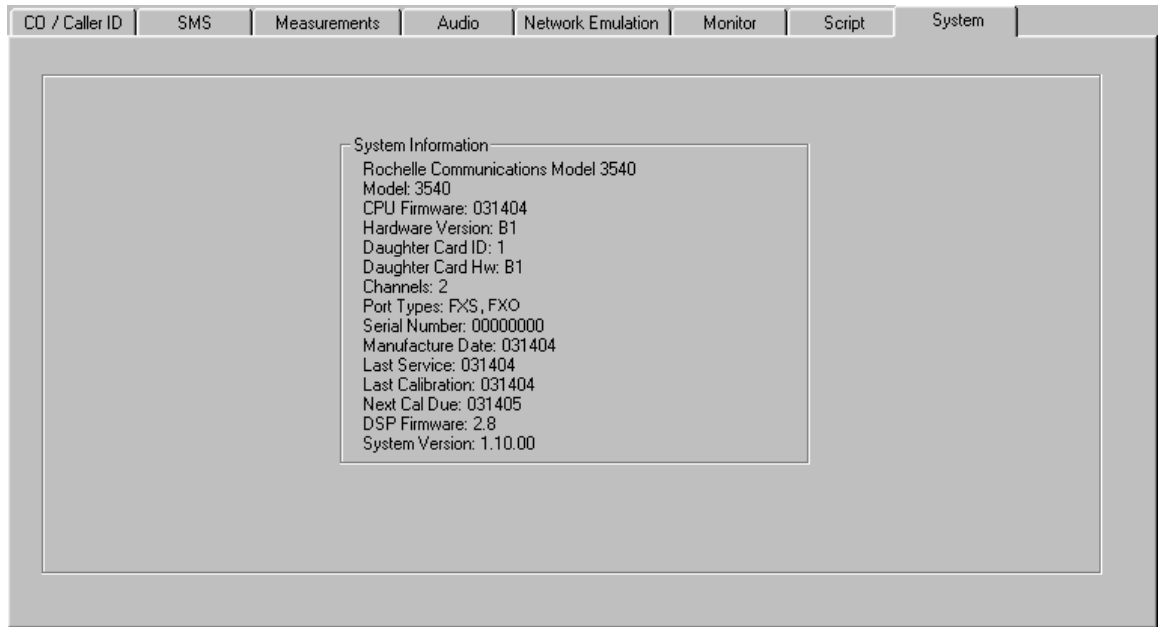
Click the Run button to run the displayed script.

Click the Checksum button to calculate the Checksum for the displayed script. The checksum is helpful in comparing two script files.

Anytime you press the Send Channel A or Send Channel B button on the **CO Setup** or **SMS** function tab, a script is automatically created and displayed on the **Script** screen.

See the **Script Command** section of this manual for a listing of script commands.

System



System Function Tab

The System function tab shows all current hardware and software information for the Model 3540.

Script Commands

General Syntax

- ✓ Only one command per line
- ✓ Blank lines are allowed
- ✓ Tabs and additional spaces are ignored
- ✓ Text following a '*' is a comment
- ✓ Command are case-insensitive

Setting and Control commands

chan_seizure

Description:

Specifies the number of channel seizure bits (alternating 1's and 0's) preceding the mark bits of an FSK message. Default is 300.

Default: 300

Range: 0 to 999

Example:

chan_seizure 250 *specifies 250 channel seizure bits

channeltype

Description: Specifies the type of channel for channel a or channel b:
CO: specifies a central office connection on the active channel
The active channel is specified by the port command.

Example: port a

colevel

Description: Specifies the absolute value of the DC voltage of the CO simulator. The actual voltage is negative in respect of tip to ring.

Range: 10 to 48

Default: 48

Example: colevel 48 *applies a CO voltage of -48Vdc to the active channel

cpu

Description: Sends a command directly to the 3540 cpu.

Example: cpu AT_S10=0 *this will send an "AT_S10=0" command to the cpu

delay

Description: Delays a specified number of milliseconds.
Range: 0 to 65000 milliseconds
Example: delay 300 * delay script execution for 300 milliseconds

detect, nodetect

Description: These commands enable and disable detection of the events specified by the parameter. Note that CAS detection and FSK detection are mutually exclusive when enables with this command. (Enabling CAS disables FSK detection, and enabling FSK disables CAS detection).

Parameters:

- fska – fsk detection on channel a
- fskb – fsk detection on channel b
- casa or casa_onhook – on hook CAS tone detection on channel a
- casb or casb_onhook – on hook CAS tone detection on channel b
- casa_offhook – off hook CAS tone detection on channel a
- casb_offhook – off hook CAS tone detection on channel b
- ringa – ring detect on channel a
- ringb – ring detect on channel b
- dtmfa – dtmf tone detection on channel a
- dtmfb – dtmf tone detection on channel b

Example:

detect fska *enable fsk detection
nodetect ringa *disable ring detection on channel a

dsp

Description: Sends a command to the 3540 DSP. Comment is **not** allowed on the line.
Example: * sends “bitrate 1150” to the 3540 DSP,

impedance

Description: Specify the impedance for the active channel.

Parameters:

- CTR21: impedance for terminal equipment in Europe
- 600ohms (North America)
- BRIDGE: high impedance bridge

Default: 600ohms

Example: impedance ctr21

goonhook

Description: Goes on-hook if the channel is configured as FXO.

gooffhook

Description: Goes off-hook if the channel is configured as FXO.

markbits

Description: Specify the number of mark bits that will precede any sent FSK messages.

Default: 300

Range: 0 to 999

Example: markbits 80

markfreq

Description: Specify the FSK frequency for a mark bit (1).

Range: 1100 to 1400 (Hz)

Example: markfreq 1300

marklevel

Description: Specify the level of a mark bit in dBm.

Range: -50 to 4 (-50dbv to 4dbv)

Example: marklevel 0 *mark bit signal will be 0 dBm.

Example: marklevel 0dbv *mark bit signal will be 0 dBV.

markout

Description: Specify the number of mark bits that will follow and FSK transmission.

Range: 0 to 999

Default: 0

Example: markout 10

markstuff

Description: Specify number of mark stuffing bits.

Range: 0 to 150

Default: 0

Example: markstuff 1

polarity

Description: Used to reverse the polarity on the active channel

Parameters: reverse or normal

Example: polarity reverse

ring

Description: Turns the ringer on or off for the active channel.

Parameters: ON or OFF

Example: Ring ON

ringfreq

Description: Specify the ring frequency in Hz.

Range: 5 to 90
Default: 25
Example: ringfreq 20

ringlevel

Description: Specify the amplitude for the ringing signal.
Default: 65
Range: 10 to 90
Example: Ringlevel 50 * specify 50 Vrms ring level

send

Description: Sends an FSK stream defined by data in quotations. The data can contain ASCII characters and/or any 8 bit hex values enclosed in angle brackets.

spacefreq

Description: Specify the frequency of a space bit (0) for an outgoing FSK message.
Range: 2000 to 2300 (Hz)
Example: spacefreq 2100

spacelevel

Description: Specify the level of the signal for a space bit in dBm.
Range: -50 to 4 (-50dbv to 4dbv)
Example: spacelevel 0 * 0 dBm for space bits
Example: spacelevel 0dbv * 0 dBV for space bits

tone1

Description: Turns tone generator #1 on or off.
Example: tone1 on

tone1freq

Description: Specify frequency for tone generator #1.
Range: 10 to 10000 (Hz)
Example: tone1freq 1200

tone1level

Description: Specify amplitude for tone generator #1
Range: -50 to 4 dBm (-50dbv to 4 dbv)
Example: tone1level 0
Example: tone1level 0dbv

tone2

Description: Turns tone generator #2 on or off.

Example: tone2 on

tone2freq

Description: Specify frequency for tone generator #2.

Range: 10 to 10000 Hz

Example: tone2freq 1200

tone2level

Description: Specify amplitude for tone generator #2

Range: -50 to 4 dBm. (-50dbv to 4 dbv)

Example: tone2level 0

Example: tone2level 0dbv

Logical Script Flow commands

breakrepeat

Description: When encountered, the execution will jump ahead to the command following the endrepeat command for the current repeat loop.

Example: <see repeat, endrepeat>

call

Description: calls a procedure previously defined by proc/endproc

Example: <see proc, endproc>

cleartimer1

Description:

Clears the timer previously started by starttimer1 or starttimer2 such that the timer expiration will not generate an event.

if, else, endif

Description:

If the condition following the “if” statement is met, the commands that follow will be executed. Otherwise, the commands that follow an optional “else” statement will be executed. The if statement must be followed at some point by an “endif” statement. The condition is a predefined variable (currently “fsk” and “dtmf” are the only predefined variable), followed by an optional index in parenthesis (0 by default), followed by either an = or a !=, followed by a hexadecimal value. The index specifies which byte in the array to compare to the hexadecimal value.

Example:

if fsk(0) = 93 *DLL_SMS_EST received - 93 hex


```

        *now send message
        delay 800
        nodetect fska *disable fsk detection
        send "text omitted for example"
    else
        pause "unrecognized ACK"
        goto FAIL
    endif

```

goto, label

Description:

The goto statement immediately takes the script execution to the line identified by a “label” command and the matching label.

Example:

```

* a goto FAIL statement will take the execution here...
LABEL FAIL
result fail
stop

```

pause

Description:

This will display a popup window with the string specified in double quotes. The script execution will continue when the user clicks OK in the popup window.

Example:

```

pause "unrecognized ACK"

```

port

Description:

Specifies the active channel. The commands that follow will be applied to either channel A or channel B.

Parameters:

A or B

Example:

```

port a

```

proc, endproc

Description:

defines a procedure that can be called elsewhere in the script

Example:

```

proc sendcas
    tone1freq 2130
    tone2freq 2750
    tone1 on
    tone2 on
    delay 100
    tone1 off
    tone2 off
endproc
call sendcas

```

repeat, endrepeat, breakrepeat

Description:

The commands in between the “repeat” and the “endrepeat” commands are executed until either a breakrepeat is encountered, or the number of iterations specified by the repeat command has been completed.

Example:

```
* this will apply 20 rings to the active port
repeat 20
    ring on
    delay 2000
    ring off
delay 4000
endrepeat
```

starttimer1, starttimer2

Description: Starts a timer.

Parameter: number of milliseconds.

Example: <see wait, on>

stop

Description: Aborts script execution.

wait, endwait, on, endon

Description:

A wait/endwait block suspends script execution until one of the events specified by an on command occurs. The on/endon blocks inside the wait/endwait blocks contain the script commands to be executed if a specified event occurs. The events allowed are:

- a_idle – device connected to port a goes on hook
- a_offhook – device connected to port a goes off hook
- a_dtmf_detected – DTMF tone detected on channel a
- a_cas_detected – cas tone detected on channel a
- a_reverse_polarity – polarity reversal detected on channel a
- a_fsk_received – and fsk string is detected on channel a

All these events are available for channel b by replacing the above a_ prefix with a b_ prefix

timer

Description: timer1 – timer started by starttimer1 has expired
timer2 – timer started by starttimer2 has expired

Example:

```

*****
*RECEIVE DLL_SMS_ACK, SEND DLL_SMS_REL
*****
starttimer1 5000
detect fska *enable fsk detection
wait
    on a_fsk_received
        cleartimer1
        if fsk(0) = 95 *sign-off received
            nodetect fska
            delay 800
            send "<94><00>I"
        else
            pause "unrecognized ACK"
            result fail
            stop
        endif
    endon

    on timer1
        pause "ack timeout"
        result fail
        stop
    endon
endwait

```

Model 3540 Specifications

Note: Accuracy is given in (parenthesis) unless otherwise noted.

Central Office Simulation

Type:	2-wire, loop start
AC Impedance:	600 (+/- 25) Ohms or CTR21 complex [270 Ohms + (750 ohms // 150nF)]
DC Voltage:	Programmable -15 VDC to -48 VDC (+/- 1 V), Software-controlled polarity
Line Current Feed:	Limited to 30 mA
Ringer:	Programmable 10 to 90 VAC RMS (+/- 2V for 20 to 80 Hz); Frequency: 10 Hz to 100 Hz (+/- 1 Hz); Cadence in mS.
Call Progress Tones:	Worldwide
Idle Channel Noise:	< 10 dBrnC

FSK Generator

Standards:	Bell 202 or ITU V.23
Modes	Simplex or half-duplex
Dynamic Range (TX):	-50 dBm to +4 dBm (+/-0.5 dBm)
Receiver Sensitivity:	-30 dBm with SNR > 14 dB

FSK Impairments

FSK Mark Frequency:	1100 Hz to 1400 Hz (+/- 1 Hz)
FSK Space Frequency:	2000 Hz to 2300 Hz (+/- 1 Hz)
FSK Mark / Space Twist:	-10 dB to +10 dB (+/- 0.5 dB)
Bit Rate:	1150 to 1250 bps (+/- 0.2 bps)
Stuffed Mark Bits:	0 to 150 bits (+/- 1 bit)
Trailing Mark Bits:	0 to 999 (+/- 1 bit)
Echoes:	2 independent echoes. Delay: 0.0 to 20.0 ms (+/- 0.3 ms); Attenuation: 0 to 48 dB (+/- 0.5 dB)
White Noise:	10 dBrnC to 80 dBrnC (+/- 1 dBrnC)
Interfering Tone:	10 Hz to 10,000 Hz (+/- 1 Hz). -48 to +2 dBm (+/- 0.5 dBm, 300 to 4000 Hz.)

DTMF Receivers

Frequency Deviation Accept:	+/- 1.5% +2 Hz nominal
Frequency Deviation Reject:	+/- 3.5% +2 Hz nominal
Amplitude for Detection:	-30 dBm to 0 dBm per tone

Maximum Twist Allowed:	8 dB
Minimum ON Duration:	40 ms or greater
Minimum OFF Duration:	40 ms or greater

USB Digital Audio Processor

Controller:	Philips UDA1325H/104 with integrated 16-bit CODEC
Type:	Full-duplex stereo record and playback
Frequency Characteristics:	Flat, 20 Hz – 10 kHz (+/- 0.5 dB for 300 to 4000 Hz.)
Audio Format:	16-bit PCM, 22 kHz sampling rate, .WAV format compatible
Audio Record Sources:	Left: Ch. A RX, TX, or Bridge Right: Ch. B RX, TX, or Bridge
Audio Playback (Outputs):	Left: Channel A Right: Channel B

Audio Monitor Speaker and Headphone Port

Audio Monitor Sources:	Ch. A RX, Ch. A TX, Ch. A Bridge (default), Ch. B TX, Ch. B Bridge, USB Audio Output (Left), and USB Audio Output (Right); Software-selectable.
Audio Monitor Level:	Manual volume control knob on front panel with software mute function.
Speaker:	Hi-Fi Micro-Speaker, 1 watt max output, 8 ohms impedance, full-range audio response. Speaker is muted when headphone is connected.
Headphone Jack:	3.5 mm, mono

Caller ID Simulation and Decoding

Types:	Type I (on-hook) and Type II (off-hook)
Signaling:	Bell 202 FSK, ITU V.23 FSK, and DTMF
Standards Support:	Telcordia GR-30 and SR-3004, TIA 716, ETSI ETS300 778-1/2, NTT, and various national standards

Fixed-Line SMS Service Center (SC) Emulation

Signaling:	ITU V.23 half-duplex
Protocols:	Protocols 1 and 2
Standards Support:	Simple SC simulation based on ETSI ES-201-912 V.1.1.1 standard.

Measurements

Signal Conversion:	Calibrated 16-bit A/D Converter and a 14-Bit CODEC; True RMS readings.
Receive Signal Level:	10 to 10000 Hz (default) or Notch Filter. (+/- 0.5 dB, 300-4000 Hz.)
Speech Level:	As per ITU P.56 standard, method B. (+/- 0.5 dB.)
Idle Channel Noise:	C-Message and D filters with 1010Hz notch option, as per IEEE 743-1995. (+/- 1.0 dB.)
DTMF Analysis:	Level Accuracy: +/- 0.5 dB, Twist Accuracy: +/- 1 dB, Duration Accuracy +/- 2 ms
Programmable Tones:	10 Hz to 10000 Hz (+/- 0.5 Hz) -50 dBm to +4 dBm (+/- 0.5 dBm from 300 to 4000 Hz)
Noise Generation:	Pseudo-random white noise, 10 to 80 dBmC (+/- 1 dBmC)

Network Emulation

Attenuation:	0 to 50 dB (+/- 1 dB, 300-4000 Hz.)
Return Loss:	12 to 34 dB (+/- 2 dB, 300-4000 Hz.)
Echo:	-50 to 6 dB (+/- 2 dB, 300-4000 Hz.), 5 to 1000 mS (+/- 0.3 mS)

USB Interface to Host PC

Type:	Full-speed (12 MHz) function device. Compatible with USB Specifications, Rev. 1.1 and 2.0
Topology:	Self-powered embedded 4-port hub with one upstream and four downstream ports. One downstream port connected to one full-speed USB digital audio controller and two downstream ports to two full-speed USB serial UARTs.

Power

AC Input Range:	Universal input (100 - 240 VAC / 50 - 60 Hz), 1.5A maximum
-----------------	--

Safety

CSA (Level 3), CE (73/23/EEC), VDE (IEC950), UL (1950), NEMKO (EN60950). Rated for indoor use only.

FCC Part 15:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will have to correct the interference at his or her own expense.

Mechanical

Dimensions: 10" x 12.6" x 2.6" (25 cm x 33 cm x 7 cm)

Weight: 8 lbs. (3.6 kg)

Environmental

Operating Temperature: 50 °F to 104 °F (10 °C to 40 °C)

Storage Temperature: -4 °F to 149 °F (-20 °C to 65 °C)

Relative Humidity: 10% to 90%, non-condensing

Internal Fan: Speed 4800 RPM; Airflow 5.7 CFM;
Noise level 19 dB-A

Host Computer Requirements

Processor: 500 MHz minimum

System Memory: 256 MB RAM minimum (512 MB or greater recommended)

System Storage Memory: At least 20 MB of available hard disk space.

Operating System: Microsoft Windows 98SE/ME/2000/XP

USB Host: One available USB port, compatible with USB Specifications Rev. 1.1 or 2.0.

Audio Subsystem: Internal sound card required

Appendix 1: SMS Timing Parameters

The following SMS Timing Parameters are reproduced from the ETSI specification ES 201 912 for Fixed Line Caller ID. The specification may be downloaded free of charged from http://www.etsi.org/services_products/freestandard/home.htm

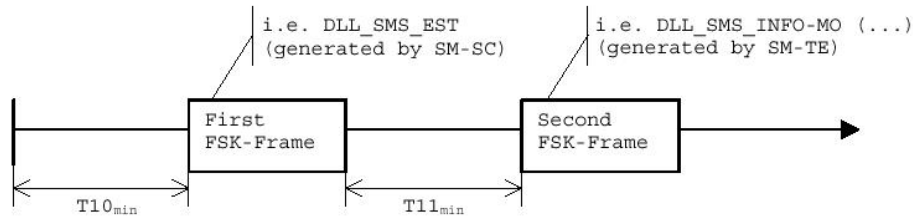


Figure 11: Timing diagram for a SM-TE originated call

To ensure that all involved network elements are in a state that permits the FSK information to be transmitted properly, a minimum delay time (T10) between the accepting of the call and the sending of the first FSK-Frame shall be kept by the answering entity. The minimum length of this delay shall be:

$$T10_{\min} = n \times 100 \text{ ms}; \quad n = 1..256$$

The integer value n shall be defined by the network operator.

Due to the used half duplex communication via a network in which echo-suppressors or echo-cancellers may be active, a minimum delay time between two successive FSK frames of:

$$T11_{\min} = 100 \text{ ms}$$

shall be kept (ITU-T Recommendation V.25 [11]). This value takes in consideration the network echo suppressor suppression hangover time.

Table 7: Response time

Time	Description	Start	Value (ms)	Application
T1	Timeout for sending an acknowledgement to the received message.	End of the reception of a message.	200	Slave
T2	Timeout for sending a message.	End of the reception of the "Link Established Message" or of an acknowledgement.	200 (see note 2).	Master
T3	Timeout for sending the "Link Established Message".	Connection establishment.	n'x100 (see note 3).	Slave

Table 6: Timers						
Timer	Description	Start	Stop	Action at the timer expiry	Duration ±10 % (ms)	Application
Tm1	Maximum waiting time for receiving an acknowledgement message from the Slave.	End of the Info message transmission.	Acknowledgement reception.	Sending of a DLL_SMS_ENQ message.	800	Master
		End of the Command message transmission.		Sending again of the last Command message.		
Tm2	Maximum waiting time for receiving a message from the Master.	End of the transmission of the "Link Established Message" or of an acknowledgement.	Message reception.	Hanging on.	7 600	Slave
Tm3	Maximum waiting time for receiving the "Link Established Message".	End of the dialling phase.	"Link Established Message" reception.	Hanging on.	7 500	Master
Tm4	Waiting time for hanging on after a release request.	Acknowledgement of a DLL_SMS_REL message.	DLL_SMS_REL message reception.	Hanging on.	3 500	Slave
Tm5	Waiting time for sending a DLL_SMS_ENQ message to maintain active the Data Link level.	Reception of a positive acknowledgement without TL corresponding to a non extended info message or to a DLL_SMS_ENQ message sent to maintain active the Data Link layer.	Reception of a DLL_SMS_ACK-x with TL.	Sending of a DLL_SMS_ENQ message.	800	Master
Tm6	Waiting time before sending a positive acknowledgement without TL payload.	Transfer of the received payload to TL.	TL Response available (see note 1).	Sending of DLL_SMS_ACK-x without TL payload.	200	Slave
Tm7	Waiting time for forcing the disconnection procedure.	Transfer of the DLL_SMS_ACK-x message to the TL.	Request of sending a message from the TL.	Hanging on.	3 500	Master

Please consult the ETSI specification and the national specifications of specific countries for further information on applicable Fixed Line SMS timing parameters.

Appendix 2: Options

The following Options are only available if purchased with the Model 3540. Please contact us at info@rochelle.com if you are interested in purchasing these options.

Handset Emulation Option

The **Handset Emulation** option allows either or both FXO ports of the Model 3540 to emulate a corded or cordless telephone handset or headset.



If the **Handset Emulation** option is available, you will see the icon in either or both Channel Configuration boxes at the bottom of each Model 3540 screen.

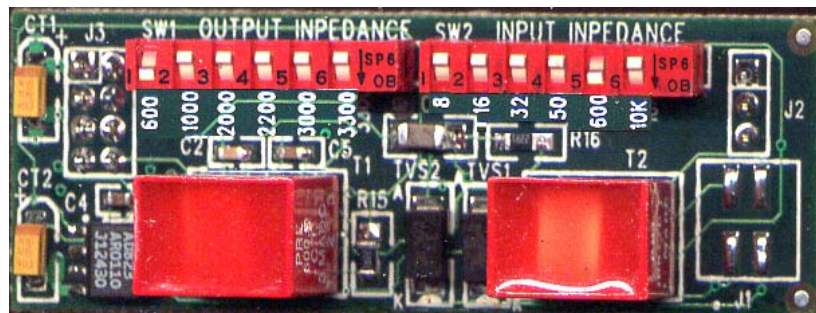
If the **Handset Emulation** option is available, you will also see either two or four 3.5 mm stereo jacks installed on the back of the Model 3540. These jacks are marked “A” and/or “B” for the channel in use, and “M” for “Microphone, and “S” for Speaker.

The “Microphone” jack provides audio out of tip and ring of the M jack on the rear of the Model 3540 and should be connected to the microphone circuit of the Device Under Test.

The “Speaker” jack provides audio into tip and ring of the S jack on the rear of the Model 3540 and should be connected to the speaker circuit of the Device Under Test.

The Microphone and Speaker impedances are set by dipswitches on the Handset Simulation board inside the Model 3540. Both boards default to 600 Ohms.

Use the following procedure for changing the dipswitches. Refer to the following image of the board:



- Turn off the Model 3540 and unplug the power and USB cables
- Wear a static-protection wrist strap that is properly grounded
- Remove the four screws from the Model 3540 front panel
- Slide the top cover off the Model 3540
- Locate the **Handset Emulation** boards: Channel A is the board towards the front of the Model 3540, and Channel B is the board toward the rear
- Flip the dip switches according to the values printed on the board (shown above)
 - Reinstall the top cover and the screws for the front cover
 - Reconnect the Model 3540 power and USB cables and turn the unit on.

The Model 3540 **Handset Emulation** will now have the new microphone and speaker impedances.

PESQ

PESQ (Perceptual Evaluation of Speech Quality) is a method defined by the ITU-T P.862 standard for measuring voice quality over a PSTN or VoIP network or telephone.

The Model 3540 **PESQ** option automatically plays a reference audio file on one channel while simultaneously recording the audio from the network or telephone on a second channel. The PESQ algorithm then compares the two files and calculates and displays a PESQ score and other relevant parameters.

Following is a screenshot of the Model 3540 PESQ function:

The screenshot shows the Model 3540 PESQ function interface. At the top, there are two radio buttons: "Play Channel A - Record Channel B" (selected) and "Play Channel B - Record Channel A". Below this is the "Play Reference File" section, which includes a text box containing the file path "C:\cygwin\home\Robert\RochelleNewScreens\pesqOEM\Ref.wav" and a "Browse" button. A volume slider is positioned below the text box, with "Level" set to "0 dB" and a range from "-55.0" to "+20.0". The "Record Degraded File" section has a text box with the path "C:\cygwin\home\Robert\RochelleNewScreens\pesqOEM\3540Test" and a "Browse" button. Below these sections, several parameters are displayed in text boxes: "Reference Level" (-30.425 dBov), "PESQ (P.862)" (4.482), "Noise" (-63.438 dBov), "Degraded Level" (-30.423 dBov), "MOS (P.800)" (4.979), "Delay" (228.251 ms), and "Attenuation" (-0.035 dB). At the bottom, there are five buttons: "Ready" (with a red square icon), "Elapsed Time" (with a text box showing "0"), "Play & Record" (with a green play button icon), "Stop" (with a black square icon), and "Calculate" (with a PESQ logo icon).

Select **Play Channel A – Record Channel B** or **Play Channel B – Record Channel A** to set the play and record paths for the measurement.

Enter the name of the **Reference File** to be played, or click on the Browse button to locate a directory and file. This is the file that is played to the network or telephone.

You may also set the level of the played file. **Note:** This level is set inside the Model 3540 and does not affect the PC sound card audio level set by the Windows™ Volume Control. It is recommended that the Windows™ Volume Control be set to maximum.

Enter the name of the **Degraded File** to be recorded, or click on the Browse button to locate a directory and file. This is the file that is recorded from the network or telephone.

Note: It is recommended that the Windows™ Recording Level be set to maximum.



Click  to start playing and recording. The software will calculate and display the PESQ score and other parameters when playing and recording has stopped.



Click  to stop playing and recording before the played file ends. The  LED shows recording and playback is in progress.

You may also calculate the PESQ score of two files **without** playing and recording the



files. Simply enter the two file names, and click

The PESQ Calculation returns the following parameters based on the audio on the reference file and the degraded file.

Note: dBov means “dB overload” where the point of reference is the theoretical system overload point, which will vary depending on the sound card in the host computer.

Reference Level: This is the average level of the played file. **Note** this is not the same as the level of the electrical signal on the transmit port.

Degraded Level: This is the average level of the recorded file. **Note** this is not the same as the level of the electrical signal on the receive port.

Attenuation: This is the difference in the average level of the played file and the recorded file. **Note:** this value of attenuation should be the same as the attenuation of the electrical signals on the transmit and receive ports.

PESQ: This is the score calculated by the PESQ algorithm in accordance with the ITU-T P.862 standard where 4.5 is a perfect score and 1.0 is the worst possible score.

MOS: This is the old MOS score calculated in accordance with the ITU-T P.800 standard where 5.0 is a perfect score and 0.0 is the worst possible score.

Noise: This is the average noise of the degraded file. **Note:** you can measure the average noise on the reference file by entering the reference file as both the Play and Record file and clicking the PESQ button. Take care **not** to click the Play & Record button, as this will overwrite the reference file (if not write-protected).

Delay: This is the delay between the start of the Reference File and the start of the Degraded file. The total delay will include delays in the measurement system (PC sound card, USB connection, the model 3540, and reading and writing the .wav files).

Note: It is recommended that a “calibration” of the Model 3540 be performed as follows:

- Configure one channel as **FXS** (CO simulation) and the other as **FXO** (TE)
- Connect a jumper between Channel A and Channel B
- Select the appropriate Reference file and Degraded file name.
- Click the Play & Record button
- Note the Attenuation, Noise, and Delay of the measurement system.

The Attenuation, Noise, and Delay of the measurement system can then be subtracted from the measured values to get the “calibrated” Attenuation, Noise, and Delay.