MANUAL OPERATION

FUNCTIONS AND MENUS

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SECTION 1 - INTRODUCTION

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INTRODUCTION

The Telephone Network Simulator is a general purpose test set used to expedite the manufacturing and engineering laboratory testing of data communications equipment.

- *Full Featured*
- *User friendly*
- *Simulates a wide variety of telephone lines*

STANDARD FEATURES:

- Two wire and Four wire interface and network simulation
- External interfaces to telephone jack connections
- Extensive amplitude and envelope delay distortion selections
- Single button recall of central office parameters for several countries
- Ten user defined programs to instantly configure all front panel parameters
- Ability to switch the impaired channel direction
- IEEE-488 and RS-232C remote programming
- Network input power monitoring and display
- Output power level control
- Additive noise level control
- Near end echo level control
- Channel attenuation control
- True back-to-back operation
- Dialed digit analysis
- Dial and call progress features
- External balance
- Metering tones

Most of the test features are software controlled using a digital signal processing approach for implementation.

STANDARD EQUIPMENT:

- PTT 5102 (with registered serial number)
- AC Power Cord
- User's Manual

SECTION 2 - GETTING STARTED

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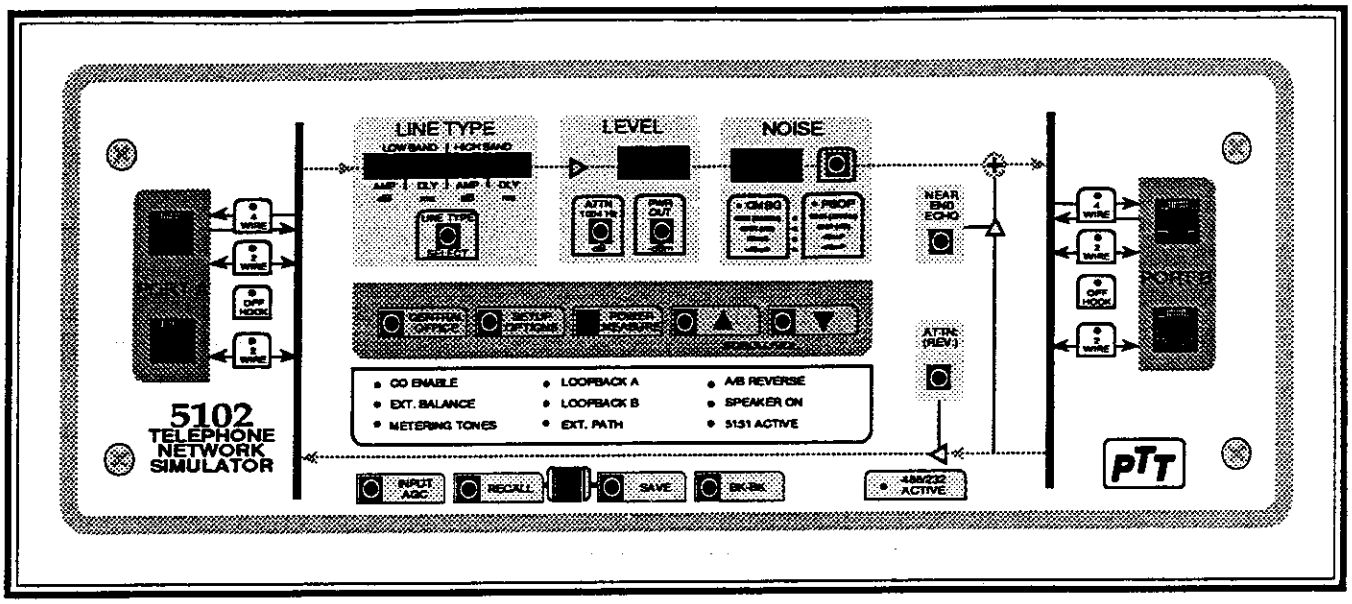
PRODUCT OVERVIEW



The PTT 5102 has the ability to simulate a wide variety of telephone lines. The front panel is designed with a block diagram approach which gives the user an intuitive guide in operating the unit. The front panel LEDs indicates the mode in which the unit is currently operating, and which features are active.

Two buttons, the CENTRAL OFFICE and the SETUP OPTIONS, are used to set the central office parameters and general features. The forward path impairments are controlled with the buttons along the top row of the front panel.

Central office simulation is accomplished on Ports A and B. The forward path (A -> B) can be impaired with amplitude and envelope delay distortion (linetype), noise, and attenuation. The reverse path (B -> A) provides signal attenuation. An Additional central office feature, metering tones, provides simulation of signals used for billing in some foreign countries. External balance capability has been provided in the 5102 for applications requiring local loop testing.

In typical applications, the modem (or other device) under test, is connected to the port B interface. The reference modem is connected to the port A interface. Certain line impairments are selected for the test. A connection is established through the PTT 5102 and data is transmitted from the modem on port A to the modem on port B. Noise level is usually varied during the test while the number of bit errors is monitored. The PTT 5102 can also be used to verify modem operation for any one of 16 different countries.

INSTALLATION PROCEDURES

Unpacking and Inspection

Carefully inspect the Model 5102 for any shipping damages. If damage is suspected, contact the carrier immediately with information regarding the damage. If possible, keep the shipping container for use in shipping the Model 5102 back for repair or as possible verification of external damage during shipment.

Verify Voltage Selection

The voltage selector (also the fuse holder) is a black inset positioned just above the power cable connector on the rear panel. It has a small window which displays the voltage number printed on a light grey inset. Four voltage selections are available: 100, 120, 220, and 240. If the displayed voltage number is incorrect, it can be changed by the following steps.

1) Grasp the left and right seating brackets of the fuse holder, squeeze both sides together and remove with a pulling action. It should slide out fairly easily.
2) With a simple pull out motion, remove the light grey inset which holds the fuse. Note the four voltage selections stamped on the end of the inset.
3) Rotate the inset to a position that displays the desired voltage numbers in the window. Replace into the fuse holder.
4) Position the fuse holder so the numbers read from bottom to top and replace it into the back panel. It should re-seat with a snapping sound.

Normal Power-Up Procedure

The power switch is located on the rear panel. Two events follow the power activation.

1) The front panel LEDs and displays are all activated to the ON conditions: the Line Type window displays "PTT 5102". This provides a visual check to see that all elements are functional.
2) After approximately three seconds the Line Type display changes to reflect the configuration that was present when the unit was powered down.

Back Door Power-Up Reset Procedure

The 5102 can be initialized to a factory set status by using a "back door" power-up procedure. ***Caution: this procedure will erase all previously saved parameters, including the front panel configuration currently being used.***

1) Turn the power "OFF".
2) Hold down both of the front panel scroll switches.
3) Turn on the power.
4) Release the scroll switches.

5102 GENERAL WARNINGS

Some operational restrictions need to be observed when using the PTT 5102. Failure to adhere to the following warnings will result in faulty simulation and will produce erroneous test results. It is also possible to damage equipment with improper connections.

1. Before turning on the power, verify that the voltage selector displays the correct voltage being used.

2. Power In must be -25 to +3 dBm. Any other Power In will result in faulty simulation and will produce erroneous test results.

3. Do no connect Tip or Ring to earth ground or short them together. (Oscilloscopes, signal analyzers, etc. should be isolated when monitoring signals on Tip or Ring.) Use of incorrect voltage can damage the equipment.

4. Do not connect unit to PBX or other telephone network outlets.

5. Do not leave the 5102 connected to unit under test when testing ESD susceptibility of other equipment such as modems, FAXes, etc.

6. The 5102 cannot have a load (600ohms) connected to both front and rear I/O telcos simultaneously.

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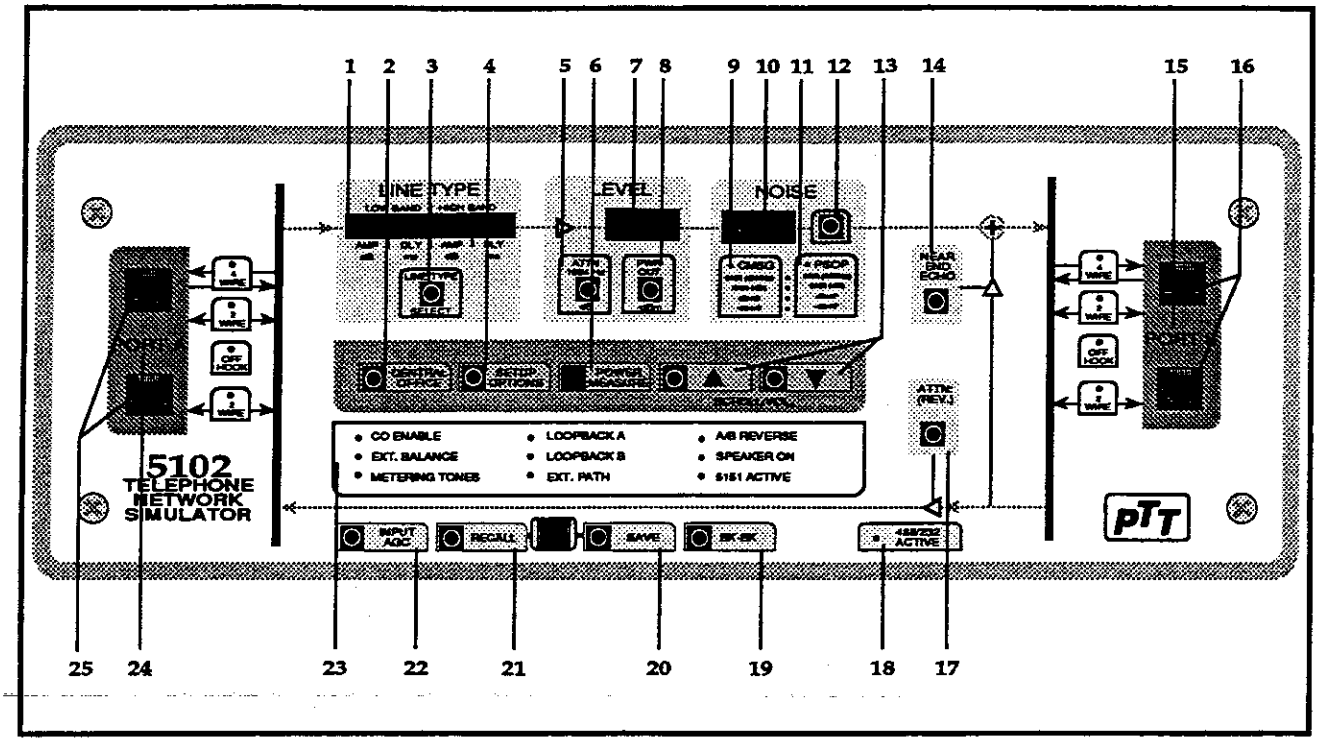
FRONT PANEL



Identification of Numbers

Item	Function
1. Line Type Display Window	Used to display Low and High Band Amplitude and Delay settings. Is also used to display active menu items for various select buttons.
2. Central Office	Select the configuration of the TELCO connectors and the characteristics of the Central Office Simulator.
3. Line Type Select	Select the amplitude and envelope delay distortion used in the signal path from A -> B.
4. Setup Options	Configure operation of the Preset INPUT function, the internal speaker, the internal signal routing, the remote control parameters, and the noise display mode.
5. ATTN 1004 HZ	Provides the capability to set the attenuation (at 1004 Hz) of the input signal at the Port A Interface.
6. Power Measure	Displays in the LINE TYPE Display Window the Network A and B interface input power and the forward channel (typically form PORT A to PORT B) output power levels.

7. Level Display Window	Displays the Attenuation or the Power Out level. (The lighted LED indicates which.)
8. Pwr Out	Used to set Network B Interface output power.
9. CMSG LED	CMSG Noise Level selected indicator. LEDs to the right indicate the noise generator characteristics.
10. Noise Display Window	Displays the Signal-to-Noise ratio or additive noise level with 3KHz C-Message or Psophometric selected. (The lighted LEDs indicate which.)
11. PSOP LED	PSOP Noise Level selected indicator. LEDs to the left indicate the noise generator characteristics.
12. Noise	Used in Conjunction with the SETUP OPTIONS to adjust the Signal-To-Noise Ratio (SNR).
13. Scroll/Vol.	Used to change the parameter value of a selected item or to control the speaker volume. If the speaker has been enabled through the SETUP OPTIONS the Scroll buttons UP or Down are used to increase or decrease the speaker volume. The blinking of the LEDs in the center of the scroll switches indicates they are active.
14. Near End Echo	Used to set the Near End Echo Level.
15. PORT B	Identifies Interface for Port B with LEDs to indicate activated wire connections.
16. Port B Connectors	Top receptacle is for an RJ45 telephone plug; bottom is for an RJ11.
17. ATTN: (Rev.)	ATTENUATION (REVERSE) set the attenuation of the input signal at the Port B Interface.
18. 488/232 Active	Indicates remote control activity through either the IEEE-488 or the RS-232C bus.
19. BK-BK	Used to provide a relay bypass of the internal electronics connecting Network A Interface directly to Network B Interface.
20. Save Button	Saves a set-up configuration for future RECALL.
21. Recall	Used to recall a previously defined and saved configuration. Scroll buttons will display memory locations 0 - 9.
22. Input AGC	Activates the Automatic Gain Control circuit to automatically determine the best operating point based on the level of the input signal to the Network A Interface.

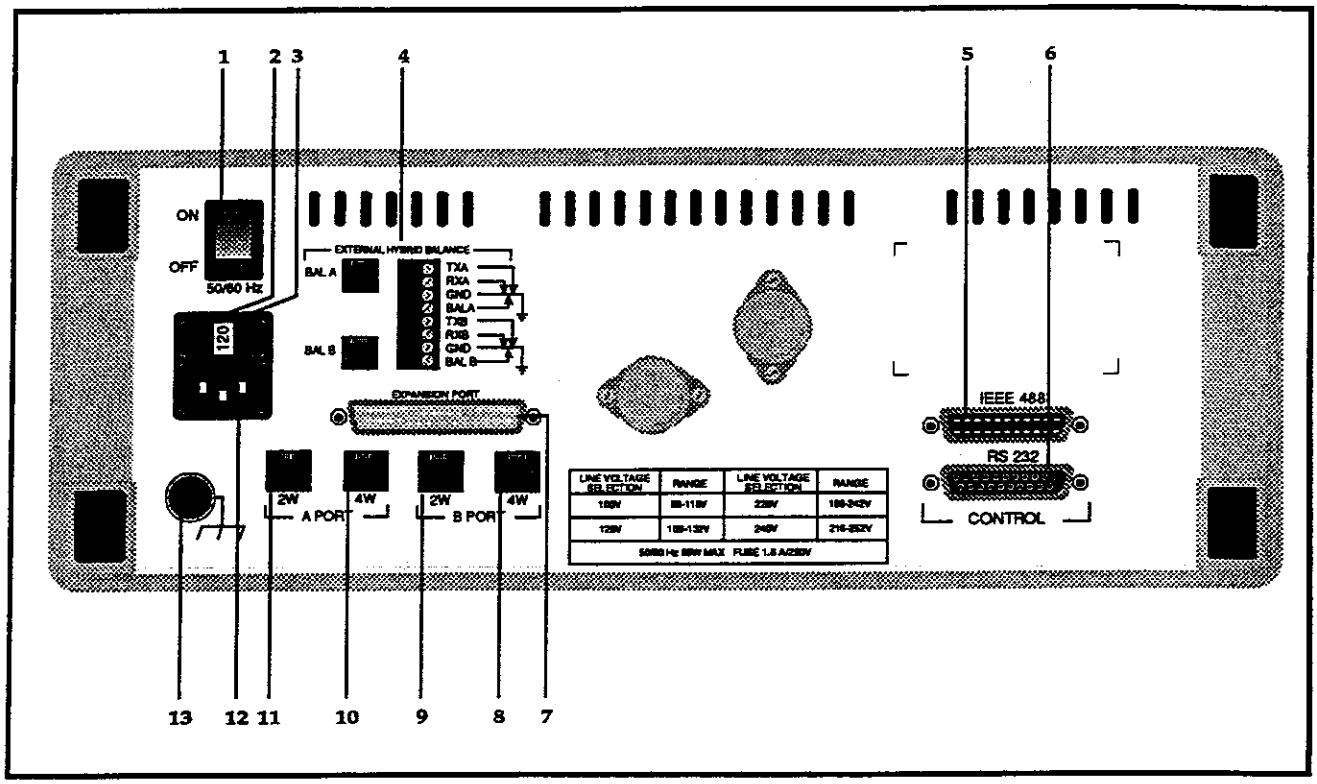
23. Configuration Indicators — These 9 LEDs indicate the current configuration of options controlled by the CENTRAL OFFICE and the SET-UP OPTIONS buttons.

CO ENABLE
EXT. BALANCE
METERING TONES
LOOPBACK A
LOOPBACK B
EXT. PATH
A/B REVERSE
SPEAKER ON
5151 ACTIVE

24. PORT A — Identifies Interface for Port A with LEDs to indicate activated wire connections.

25. Port A Connectors — Top receptacle is for an RJ45 telephone plug; bottom is for an RJ11.

REAR PANEL



Identification of Numbers

Item	Function
1. Power Switch	Turns power On/Off.
2. Voltage Selector Switch	For setting the AC input voltage used to power the 5102.
3. Fuse Holder	Placement for active, and holder for spare, fuse.
4. External Hybrid Balance Connectors a. Balance Port A b. Balance Port B c. terminal strip	Provides access to balance points for ports A and B, as well as 4-Wire signal monitoring points.
5. IEEE-488 Connector	Used for remote control of the 5102.
6. RS-232 Connector	Used for remote control of the 5102.

7. Expansion Port Connector	For connection to PTT 5151 for advanced impairments in the forward signal path.
8. B-Port 4W Connector	4-Wire interface for network Port B
9. B-Port 2W Connector	2-Wire interface for network Port B
10. A-Port 4W Connector	4-Wire interface for network Port A
11. A-Port 2W Connector	2-Wire interface for network Port A
12. Power Entry Module	Connector for AC input power.
13. Chassis Ground Connector	Used for connecting unit to earth ground when a 3-prong power outlet is not available.

GENERAL OPERATIONS AND MENUS

General Operation Method

Activate: The initial pressing of any select (operation) button will "activate" that button's menu options and the LED of the button will be blinking to indicate the button is active.

Display : Use scroll buttons to *display* menu choices. In this manual, choices are listed in order using the down scroll button. When all menu items have displayed, continued pressing of the scroll button will repeat the menu display list. Using the up scroll button will move through selections in reverse order.

Select: Press the select button again to *select* the displayed menu item. The selected item is then stored in the configuration, or if the item is a submenu choice, it become active for further selection.

Abort: To abort menus, press any other select button. All configurations entered prior to this action are recorded.

Note Two Methods

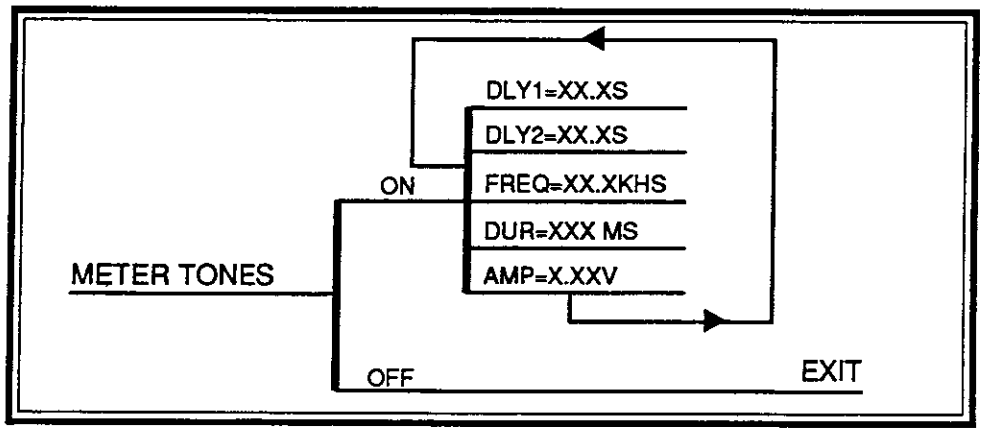
Exit:

1. Menu flows that end displaying an Exit in the menu diagram; pressing the *active select button* at the final menu choice will automatically exit the menu while also recording the selection.
2. Menu flows displaying a "wrapping" (return to selected menu item); requires the pressing of *any other select button* to exit.

The LED no longer blinks, indicating the select button is no longer active.

Menu Diagram

Each select button may have only one or multiple operations. Those with multiple operations will have **menu diagrams** to identify the location of each menu operation possible for that switch.



Menu Map

In addition, the operation of each switch that has multiple menu levels will begin with a **menu map**. Each identified selection of a menu is separated by a slash (/) mark. For example, the Menu Map

Central Office/Meter Tones/ON or OFF/Set Tones

would be operated by the following method.

Press: the **Central Office** button
Use: the **scroll** button to view 8 menu items (displayed in the Line Type window).

When Meter Tones is displayed
Press: the **Central Office** button to select that submenu
Use: the **scroll** button again to view Meter Tones submenu items, Off/ON

To turn Off:
Use: the **scroll button** to display OFF
Press: the **Central Office** button to select
Results: the Meter Tones are turned OFF and the select button is no longer active.

To turn On:
Use: the **scroll button** to display ON
Press: the **Central Office** button to select
Results: the Meter Tones are turned ON and the submenu become active.

From here the present settings can be changed:
Use: the **scroll** button to display/change the settings
Press: the **Central Office** button to select each displayed setting
Results: as each setting is recorded with the pressing of the Central Office button, the next submenu item is display.

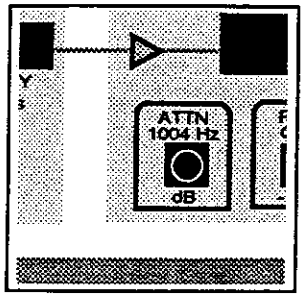
This submenu is of the "wrapping" type.

When all changes to the settings have been completed,
Press: **any other** select button to exit.

MANUAL OPERATION

FUNCTIONS AND MENUS

Purpose



The Attenuation (1004 Hz) button is used to set the attenuation (at 1004 Hz) of the input signal at the Network A interface. (B output = A input - **ATTN (1004Hz).**)

The range of settings is from a gain of 9.9 dB (setting of -9.9) to an attenuation of 55 dB in 0.1 dB steps. The setting must result in an output power greater than -55 dBm.

Operation

Press: the **ATTN (1004 Hz)** button
Results: the "level" begins to blink in the display window, as do the scroll LEDs.

Use: the **scroll** buttons to display the desired level
Press: the **ATTN (1004 Hz)** button at the desired level
Results: a "steady" display of the selected level in the "level" display window.

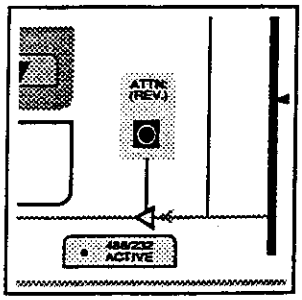
Display Window Identification

The display window used by the Attn (1004 Hz) is shared with the Power Out display. The lighted LED of these two buttons indicates which one is active.

Remote Command A1004

ATTN. REV. BUTTON

Purpose



The Attenuation Reverse button is used for setting the attenuation of the input signal at the Network B interface.
(A output = B input - **ATTN (Rev.)**.)

The range of settings is from 0 dB to 42 dB in 1 dB increments.

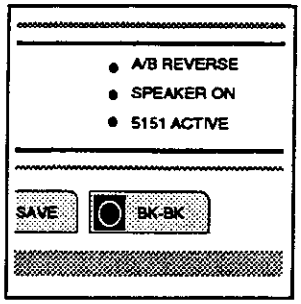
Operation

Press: the **ATTN Rev.** button
Results: the Line Type display shows REV ATN=XX DB
Where XX is the value of the reverse channel attenuator.

Use: the **scroll** buttons to display the desired setting
Press: the **ATTN Rev.** button to select

Remote Command REVATT

Purpose



The BACK TO BACK button provides a relay bypass of the internal electronics connecting Network A Interface directly to Network B Interface.

The RJ45 connectors are set in the back-to-back mode as 4-Wire devices with the normal transmit/receive reversal. There is no attenuation associated with this path. The scroll switches are not used with this feature.

Operation

Press: the **BK-BK Button**
Results: the Line Type display indicates the Back-to-Back mode is active. The Level and Noise displays are blank, indicating they are not active.

To deactivate a Back-to-Back setting, repeat the same procedure.

Note

For Back to Back selection to be available, the 5102 must be operating in one of three modes; ***2-Wire (RJ11), 2-Wire (RJ45), or 4-Wire (RJ45).*** *The corresponding LED is lighted and the Line Type display reads BACK-TO-BACK.*

Restriction

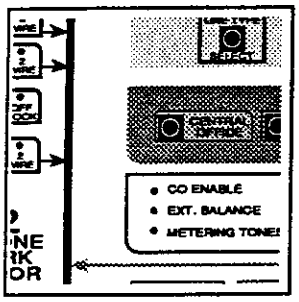
2-Wire to 4-Wire mode is not supported in Back-to-Back.

LED Response

In Back-to-Back mode, the Line Option selected and the Back-to-Back LEDs will be ON. All other LEDs will be OFF.

Remote Command BKTOBK

CENTRAL OFFICE BUTTON



The Central Office button is used to select the configuration of the TELCO connectors and the central office simulator. It contains 8 opening menu items and various submenus:

Opening Menus		Function
1. Line Options	-	select the active TELCO connectors and sets loop current.
2. Dial Report	-	View results of measurements of last dialed digits.
3. CO Select	-	Enables, selects, modifies the central office simulator parameters.
4. MOD TEL Nums	-	Modifies the programmed telephone numbers to access PORT A, PORT B, and all central office tones.
5. Loopback	-	Enables the LOOPBACK mode of operation
6. Force Ring	-	Force a ring signal to be applied to either TELCO port.
7. Meter Tones	-	Enables metering tones to be applied to the port that originates a call.
8. External Balance	-	Sets balance impedance to external control for either port.

Operation

Press: **Central Office** Button
results in a blinking display of a menu item

Use: **Scroll** buttons to view/find desired menu item

Press: **Central Office** Button at desired menu item
results in a blinking display of submenu items

Use: **Scroll** buttons to view/find desired submenu items

Press: **Central Office** Button at desired menu item

. . . continue in same manner throughout menu items.

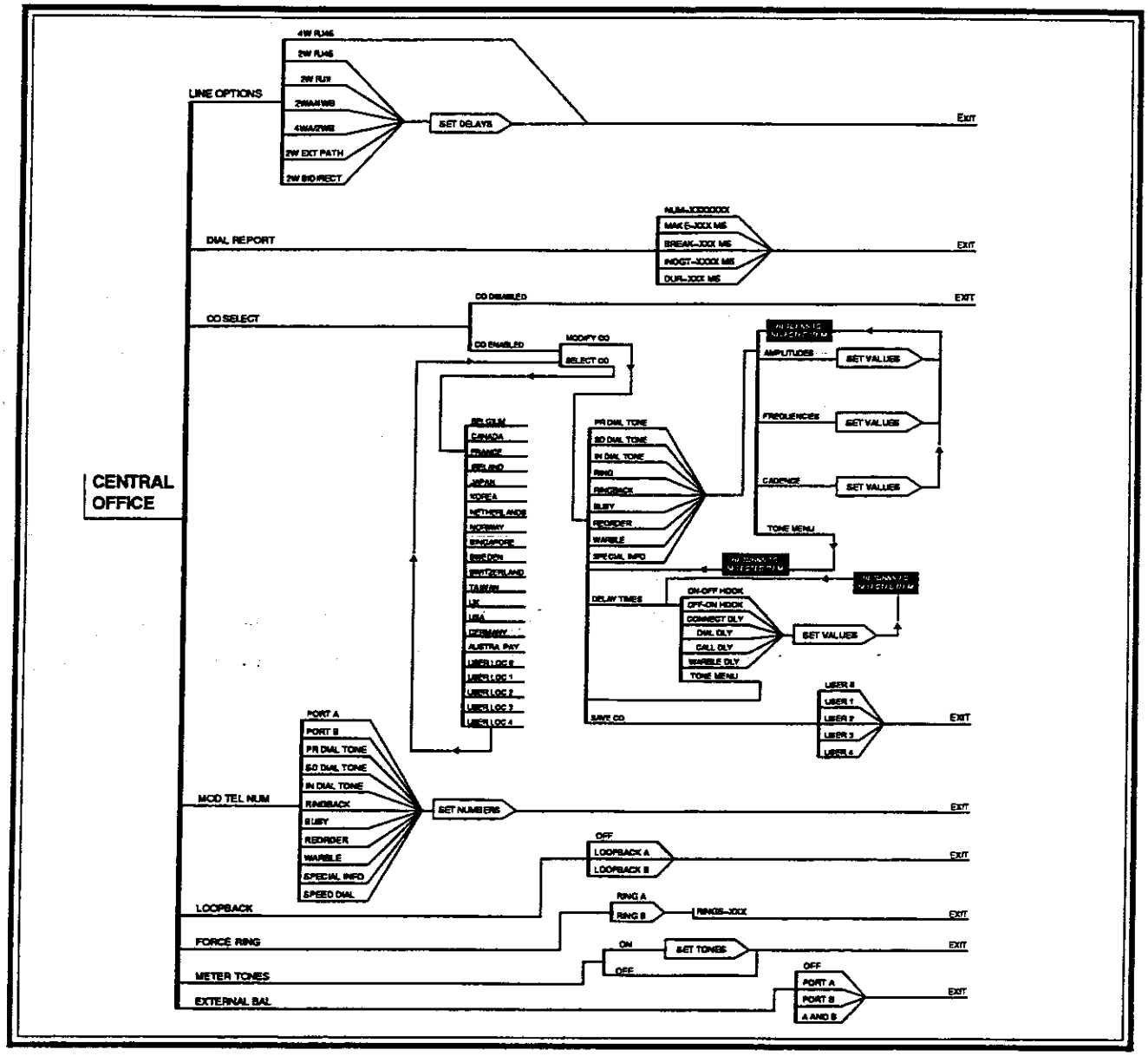
Completing and Ending

At the last menu selection, complete the selection by:

Press: **Central Office** button to enter the last selected item, and exit where menu diagrams indicate

. . . or. . .

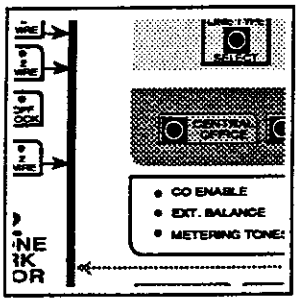
Press: any other button to exit the Central Office menu where menu diagrams indicate a "wrapping" flow..



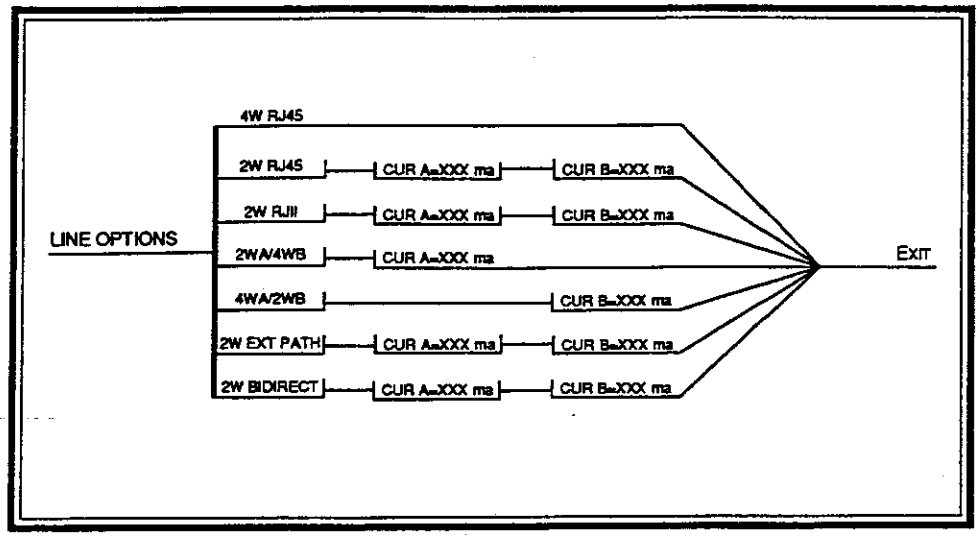
CENTRAL OFFICE BUTTON - COMPLETE MENU

Menu flow is normally depicted from left to right. When scrolling through submenu items with the **down scroll** button, the flow will wrap from bottom to top and repeat the menu order. A "back up" can be effected by using the **up scroll** button.

Purpose



Line Options is used to select active TELCO connectors and set loop current for either 2-Wire mode.



***Special Option**

To program the loop current provided to any port for 2-Wire simulation mode, press the CENTRAL OFFICE button at the 2-Wire menu selection. Use the scroll buttons to select a value between 0 and 120 mA. After programming the current for each 2-Wire port, press the CENTRAL OFFICE button to exit.

Menu Map

Central Office: Line Options/Submenus

Submenus 1 - 7

1. **2-Wire RJ11** - Simulated 2-Wire lines (RJ11 connectors).
   CUR A=XXXma } see *Special Option
   CUR B=XXXma }
   LED Response - Both left and right bottom 2-Wire LEDs are lit.

2. **2WA/4WB** - Port A Interface 2-Wire (RJ11 connectors) and Port B 4-Wire (RJ45) with 2-Wire loop current.
   Submenu - Cur A=XXXma} see *Special Option
   LED Response - Left bottom 2-Wire and top right 4-Wire LEDs are lit.

3. **4WA/2WB** - Port A Interface 4-Wire (RJ45) to Port B Interface 2-Wire (RJ11) with 2-Wire Loop Current (no dial features).
   Submenu - Cur B=XXXma} see *Special Option
   LED Response - Right bottom 2-Wire and top left 4-Wire LEDs are lit.

4. **2W EXT PATH** - Connects the Internal 4-Wire receive and transmit signals to the RJ45 TELCO which allows external impairments to be added while in 2-Wire mode.

   Submenu - CUR A=XXXma, CUR B=XXXma } see *Special Option

   LED Response - Both bottom 2-Wire LEDs and the Ext. Path Led are lit.

5. **2W BIDIRECT** - This mode is used in conjunction with the PTT 5151 to produce bidirectional impairments. The 5102 operates primarily as a central office simulator and 2 to 4 -Wire converter. The 4-Wire impairment and features are not active. 2-Wire devices connect to the 5102 RJ11 connectors (2-Wire) and an external impairment generator may be connected to the RJ45 (4-Wire) ports.

   Submenu - CUR A=XXXma, CUR B=XXXma } see *Special Option

   LED Response - Left and Right top 4-Wire and bottom 2-Wired are lit

6. **4-Wire RJ45** - Simulated 4-Wire lines (RJ45 connectors).

   LED Response - Both left and right top 4-Wire LEDs are lit.

7. **2-Wire RJ45** - Simulated 2-Wire lines (RJ45 connectors).

   Submenu - CUR A=XXXma, CUR B=XXXma } see *Special Option

   LED Response - Both left and right top 2-Wire LEDs are lit.

Operation

Press: the **Central Office** button
Use: the **scroll** buttons to display Line Options
Press: the **Central Office** button to select
Results: display of the Line Options submenu

Use: the **scroll** buttons to display the desired line choice
Press: the **Central Office** button to select
Results: for the 4-W RJ45: the line is selected
for all other line types: the menu items proceed through the current selections.
Use: the **scroll** buttons to display the desired current
Press: the **Central Office** button to select

Continue in the same manner until all current selections are complete.
Press: **any select** button to exit

Restrictions

The 5102 will provide the designated amount of loop current regardless of the load connected to the 5102 Port. However, the loop current will be limited from the 5102 if the requested current into the desired load device would create more than a 44 volt drop across the load device. When testing with local loops, loop current should be set ≤ 25 mA (due to the large dc resistance of local loops)

*To **Enable** Central Office, the simulator must have loop current ≥ 10mA, and be operating in a 2-Wire mode.*

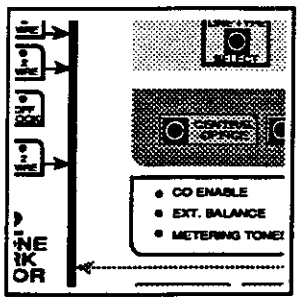
Note

All modes are shown in block diagram form as signal flow diagrams. See Signal Flow Diagrams in the Technical Reference section.

Remote Commands

LINE
LCURRENTA
LCURRENTB

Purpose

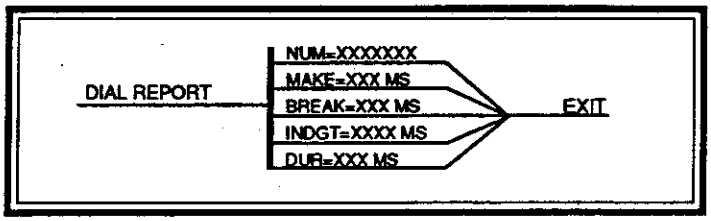


The 5102 will record measurements on the dialed digits presented at PORT A or PORT B. These measurements (for display only) include:

1. The NUMBER equals the decoding of the actual number dialed.
2. MAKE durations for pulse digits
3. BREAK durations for pulse digits
4. Tone DURATION for DTMF (touch tone) digits
5. INTERDIGIT duration for all digits

Restriction

The Dial Report feature is functional only when Central Office is enabled.



Menu Map

Central Office: Dial Report/Submenu

Operation

Press:	the **Central Office** button
Use:	the **scroll** buttons to display Dial Report
Press:	the **Central Office** button to select
Results:	the Line Display window displays the recorded measurements. This display is not available for change.
Use:	the **scroll** buttons to move through the display
Press:	**any select** button to exit

Num = xxxxxxx
This is the decoding of the actual number dialed.

Make = xxx MS
Durations for pulse digits.

Break = xxx MS
Durations for pulse digits.

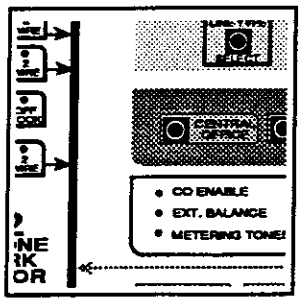
INDGT = xxxx MS
Duration for all digits.

DUR = xxx MS
Tone duration for DTMF (touch tone) digits.

Remote Commands

DIGITS
MAKE
BREAK
INTERDIGIT
DURATION

Purpose



Simulation of parameters associated with the central office call progress tones are factory set to predefined parameters for 16 different countries. Central Office simulation can be selected as enable or disabled. When CO Select is enabled, any one of the predefined country simulations may be selected.

These parameters can be used as preset, or changed using the submenu Modify CO.

Changing these parameters will not affect factory set simulations for that country. A new set of parameters will be created that can be used/saved for reuse by using the SAVE submenu under Modify CO. There are 5 User Locations (User Locations 0-4) for saving the modified CO parameters. Modified CO parameters saved in any one of them can be recalled by the CO Select options, the same as recalling any of the factory defined 16 countries.

CO Select - **Disabled:** Produces a leased line operational mode.
Enabled: Produces a 2-Wire switched line simulation. The CO Enabled LED is lighted.

Tip

When creating a CO simulation to save and reuse, it is helpful to select the country that most nearly represents the desired parameters, change as desired using the submenu Modify CO, and then save using the submenu selection 'Save'. The parameters would be stored as a User CO.

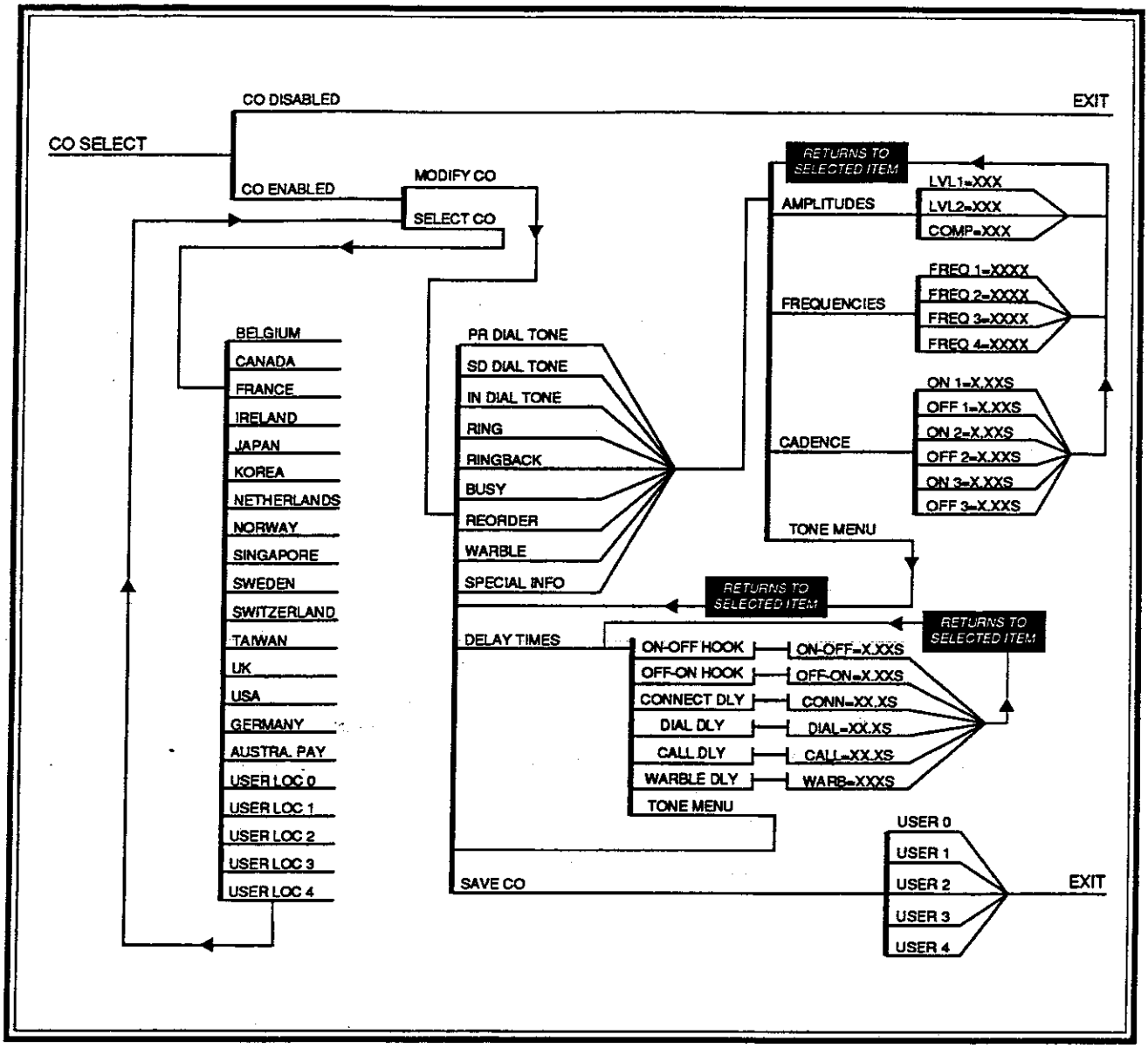
Restrictions

*To **Enable** Central Office, the simulator must have loop current ≥ 10mA, and be operating in a 2-Wire mode.*

Modified Central Office simulations can only be saved in the CO Select menu. The SAVE button can be used to save parameters that include an "active" Central Office, whether it be one of the 16 countries or one of the 5 user defined. The SAVE button will not save CO parameters that are not part of the active CO.

Settings may be individualized for the following:

- Call progress tones, such as DIAL TONE and BUSY TONE can be programmed to a set of nominal values corresponding to a particular country. See the Technical Reference Section for the values assigned to the call progress tones for each country.
- Individual tone parameters such as amplitude, frequency and cadence information can be modified by selecting Modify CO.



Menu Map

Central Office: CO Select/CO Disable/Exit

- - - or - - -

Central Office: CO Select/CO Enable/Select CO or Modify CO

Operation

To disable CO Select:

Press: the **Central Office** button
Use: the **scroll** button to display CO SELECT
Press: the **Central Office** button
Use: the **scroll** button to display DISABLE
Press: the **CO Select** button to select
Results: the window displays returns to normal display

To enable CO Select:

Press: the **Central Office** button
Use: the **scroll** button to display CO SELECT
Press: the **Central Office** button
Use: the **scroll** button to display ENABLE
Press: the **CO Select** button to select
Results: the window displays Modify CO or Select CO

To use predefined parameters: (including User Defined)

Continuing from the "enabling" operation,
Press: the **Central Office** button to activate the Select CO submenu
Use: the **scroll** button to display the desired country or user location
Press: the **Central Office** button to select the displayed country or user location
Use: **any other** select button to exit
Results: the parameters for the selected country are active and the display returns to normal

To **modify** predefined parameters: (including User Defined)

Continuing from the "CO Selected" operation,
Use: the **scroll** button to display MODIFY CO
Press: the **Central Office** button to activate the Modify CO submenu
Use: the **scroll** button to display the submenu tone choices for modification
Press: the **Central Office** button to activate the desired tone submenu displayed
Results: the display of submenu items for Delay Times or Amplitudes Frequencies, or Cadence.

Use: the **scroll** button to display the desired submenu item
Press: the **Central Office** button to selected the displayed item
Results: the display of a numerical value.

The digits activate (blink) for changing, indivually from left to right. With each press of the Central Office button, the displayed value will record and the next digit will activate (blink) for changing.

Use: the **scroll** button to display the desired numerical values

Press: the **Central Office** button to record the entry
Results: the entry is recorded and the display returns to the item selected

Other menu items can be chosen to modify in the same method. When all modifications are completed;

Use: **any other** select button to exit
Results: the parameters for the selected menu items will become active

When using **Modify CO**, the following submenu choices are available:

PR Dial Tone	Busy
SD Dial Tone	Reorder
IN Dial Tone	Warble
Ring	Special Info
Ringback	*Delay Times (additional submenu)
	*Save CO (additional submenu)

*When using any of the Modify CO submenu choices, other than Save CO or Delay Times, the selection will be followed by four choices:

- Amplitudes - choices of tone levels
- Frequencies - choices for setting frequencies for the tone
- Cadence - choices to set on/off time for tones.
- Tone Menu - will re-access thesubmenu for additional modifications.

Note *Complete information concerning Amplitudes, Frequencies and Cadences are found in Specifications of the Technical Reference Section.*

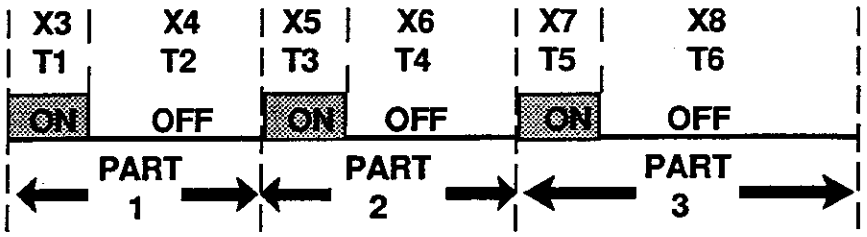
PR Dial Tone: Primary Dial Tone - composed of two single frequency tones and three cadence periods. The default number for accessing Primary Dial Tone is 555-3425 (555-DIAL).

SD Dial Tone: Secondary Dial Tone - composed of three single frequency tones and three cadence periods. The default number for accessing Secondary Dial Tone is 557-3425 (55S-DIAL).

IN Dial Tone: International Dial Tone - composed of three single frequency tones and a programmable duration period for all frequencies. The default number for accessing International Dial Tones is an 8.

Ring: Ring Signal - is generated by dialing a number that is assigned to either TELCO PORT, or by forcing ring signals from the front panel Central Office button. The RMS voltage, frequency and 3 Cadence periods are programmable.

The ring signal period is composed of 1, 2 or 3 separately controllable parts. Each part has an ON time and an OFF time. The parameters X3 through X8 specify the time values for the six intervals T1 through T6. The occurrence order of the intervals and the relationship to X3 through X8 are shown below. Note that there are constraints which govern the use of these parts.



The programming of the RING signal varies based upon the number of cadence periods required.

For a single cadence signal only PART 3 is used (i.e., use X7 and X8).

Example: RINGINGT,X1,X2,0,0,0,0,X7,X8

For a dual cadence signal use PART 2 and PART 3.

Example: RINGINGT,X1,X2,0,0,X5,X6,X7,X8

For a triple cadence signal use all arguments.

Example: RINGINGT,X1,X2,X3,X4,,X5,X6,X7,X8

Restriction *The off time of PART 3 must be equal or greater than the sum of all other parts.*

Example: $T6 \geq T1 + T2 + T3 + T4 + T5$

Ringback: Ringback Tone - is comprised of a dual tone with the **cadence periods that are the same as the RING signal.** The default number for accessing ringback is 555-2225 (55R-BACK).

Busy: Busy Tone - is sent to the originating port if the called port is off hook, or by dialing the programmable number for busy tone generation. It is composed of 2 frequencies and 1 cadence period. The default number is 555-2879 (555-BUSY).

Reorder: Reorder Tone - sent to the originating station when the dialed

number matches the programmable reorder number. It is composed of 2 frequencies and 3 cadence periods. The default is 736-7337 (REO-RDER).

Warble: Warble Tone - sent to the originating station if it remains off hook for longer than the period defined for presenting warble tone. It is composed of 2 frequencies and 1 cadence period. The default number is 592-7253 (5WA-RBLE).

Special Info: Special Information Tones - sent to the originating station if the number dialed matches the programmed special information tone number. It is composed of 4 frequencies and 4 cadence periods. The default number is 555-7732 (555-SPEC).

Delay Times: Delay Times - uses a submenu to set the time of delay between an action and the 5102 acknowledgment: actions such as a port going on or off hook, dial delays, call and warble delays .

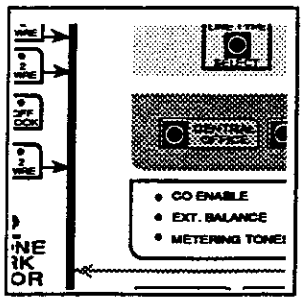
Saving Modifications

Save CO: Save Central Office - uses a submenu to save custom designed parameters with name "User 1-4". To create and save parameters for future recall, it is recommended that one of the 15 predefined countries be selected to modify. Select the one that most resembled the desired configuration,create the modification, and save it with the name User 0-4. This does not affect the parameters of the country selected for modification.

Remote Commands

PDIALT	SPECIAL#
SDIALT	DIALDLY
IDIALT	CO
RING	USER
RINGBKT	RINGINGT
BUSY	ONHOOKDLY
REORDERT	CALLDLY
WARBLEDLY	CONNDLY

Purpose

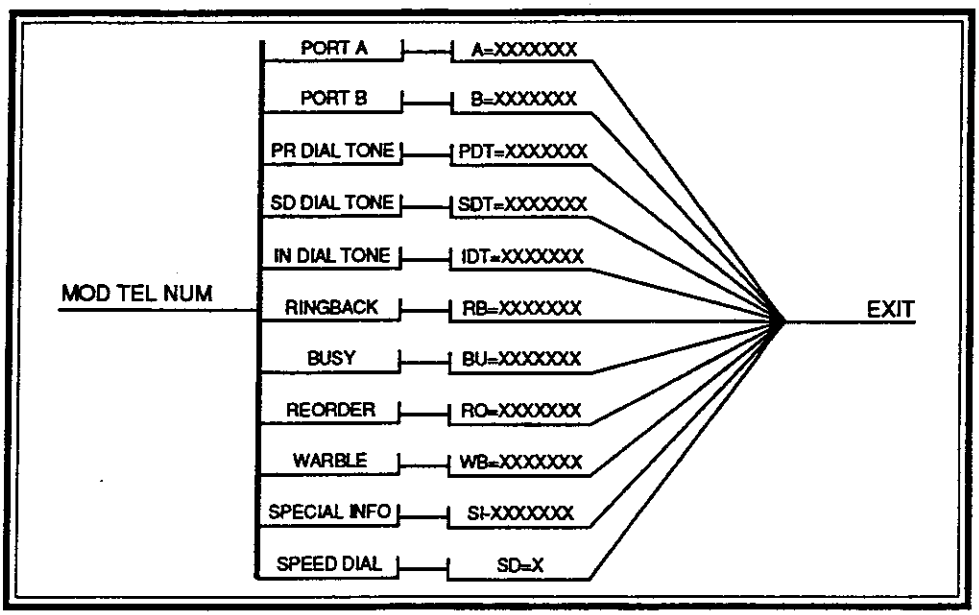


Modify Telephone Numbers (MOD TEL NUMS) is used to program the set of eleven special telephone numbers which trigger the 5102 to respond with a specific action. For example, dialing the telephone number associated with a "busy" signal causes the 5102 to respond with a BUSY tone that conforms to the associated parameter programmed for BUSY. Programmable numbers, with the exception of the SPEED dial number, may be as many as 20 digits.

The programmable numbers and preset defaults include:

PORT A	-	557-6782 (55P-ORTA)
PORT B	-	557-6782 (55P-ORTB)
PRIMARY DIAL TONE	-	555-3425 (555-DIAL)
SECONDARY DIAL TONE	-	557-3425 (55S-DIAL)
INTERNATIONAL DIAL TONE	-	8
RINGBACK Tone	-	557-2225 (55R-BACK)
BUSY Tone	-	555-2879 (555-BUSY)
REORDER	-	736-7337 (REO-RDER)
WARBLE Tone	-	592-7253 (5WA-RBLE)
SPECIAL Information tone	-	555-7732 (555-SPEC)
SPEED DIAL Number (Quick access from PORT A to PORT B or vice versa)	-	2

Restriction *The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.*



Menu Map

Central Office: Mod Tel Nums/PR Dial Tone/Modify number

Operation

Press: the **Central Office** button
Use: the **scroll** button to display Mod Tel Nums
Press: the **Central Office** button to select
Use: the **scroll** button to display the desired port, Port A or B
Press: the **Central Office** button to select the port
Results: the number to modify is displayed with the furthest to the left blinking.

Move the blinking (active) number one digit to the right by pressing the Central Office button.

Use: the **scroll** button to display the desired number
Press: the **Central Office** button to select the displayed number
Results: the selected number is displayed and the next number to the right is blinking.

Any time during the selection of numbers, pressing any other button will complete and exit the procedure.

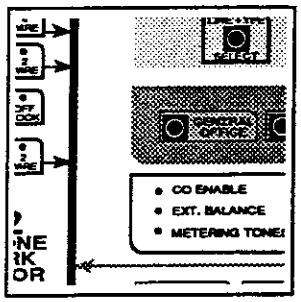
When the last number to the right change is completed,

Press: **any other** button to exit the menu.

Remote Commands

TELNUMA
TELNUMB
PDIALT#
SDIALT#
IDIALT#
RINGBK#
BUSY#
REORDER#
WARBLE#
SPECIAL#
SPEED#

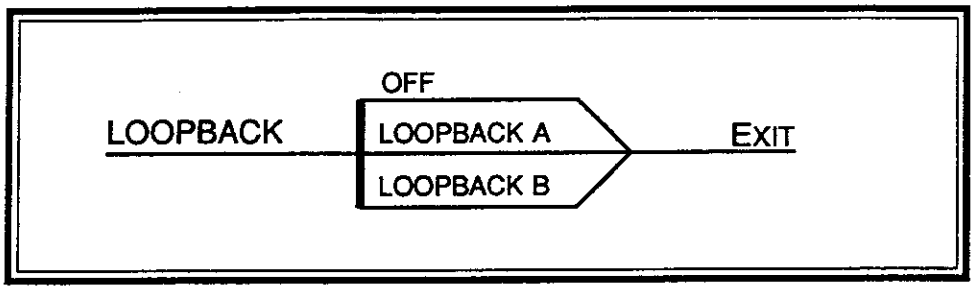
Purpose



A Loopback mode is used to internally re-route a signal.

For example, in Loopback A mode, the signal that would normally **exit** at Port A is internally routed back into the path that normally would **enter** at Port A. Therefore, as viewed from Port B the signal would enter at Port B, pass through the channel from Port B to Port A, and then back through the channel from Port A to Port B, exiting at the Port B connector.

Loopback B operates in the same manner with the A and B reversed in each case.



Menu Map

Central Office: Loopback/Loopback A (or B)

Operation

From Loopback displayed in the Line Type Window:

Press: **Central Office** button to select Loopback when displayed
Use: the **scroll** button to display Off, Loopback A or B
Press: **Central Office** button to select Loopback A or Loopback B

. . . Or, to turn off Loopback mode,

Use: **scroll** button to display Off .
Press: the **Control Office** button to select.

LED Response - Loopback A or B will be lighted.

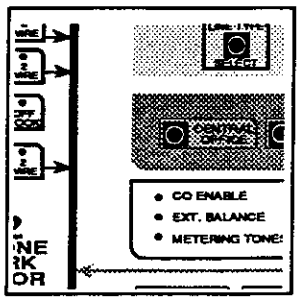
Note

Selecting A or B will disable the central office simulator.

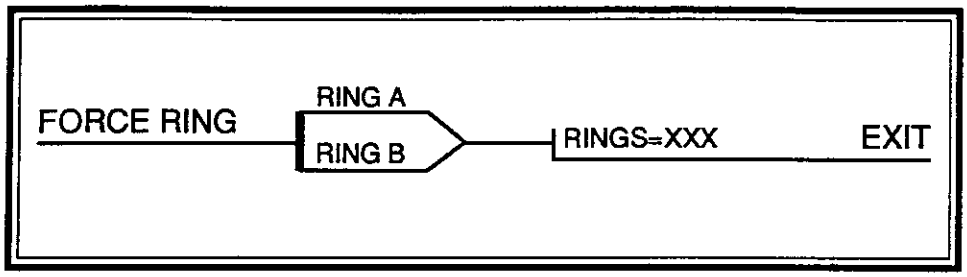
Remote Command

LBACK

Purpose



The Force Ring submenu option is used to apply a ring signal to Port A or Port B. If the device receiving the ring should go "off hook", the ring signal will be interrupted and, after a 10 second delay, a dial tone will be present.



Menu Map

Central Office: Force Ring/Ring A or B/Rings=xxx

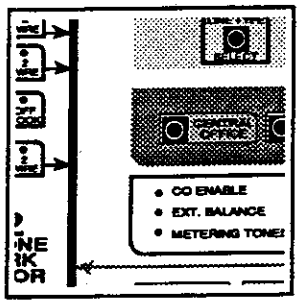
Operation

Press: the **Central Office** at Force Ring to display Ring A or B
Use: the **Scroll** buttons to change from A to B
Press: the **Central Office** to display Ring
Results: display of number of rings

Use: the **scroll** buttons to enter the desired number of rings for xxx
Press: the **Central Office** button to select displayed rings

Remote Command RING

Purpose



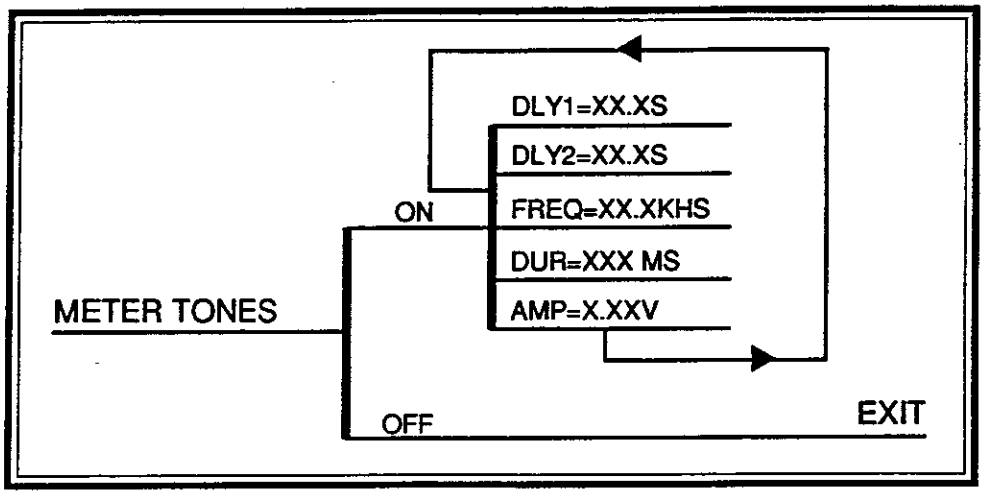
This menu item is selected to configure the metering tones (often referred to as billing tones). If the metering tones are "enabled", the tones will be generated after a 2-Wire connection is established. The tones will appear across tip and ring of the calling device.

The tones are pulses of sinusoidal waveform whose amplitude, duration and other characteristics can be programmed.

The characteristics of the tones include:

DLY1	-	initial delay time	Nominal: 0.0 sec Range: 0.0 - 25.5 sec Step: 0.1 sec
DLY2	-	repetition delay time	Nominal: 4.0 sec Range: 0.0 - 25.5 sec Step: 0.1 sec
FREQ	-	pulse frequency	Nominal: 12.0 KHz Range: 0.1 - 25.4 KHz Step: 0.1KHz
DUR	-	pulse duration	Nominal: 12.0 ms Range: 10 - 1000 ms Step: 10 ms
AMP	-	pulse amplitude	Nominal: 2.10 Vrms * Range: 0.05 - 6.00 Vrms Step: 0.05 Vrms

Note **Amplitude is calibrated into in 600Ω load*



Menu Map **Central Office:** Meter Tones/Off/On/Characteristic

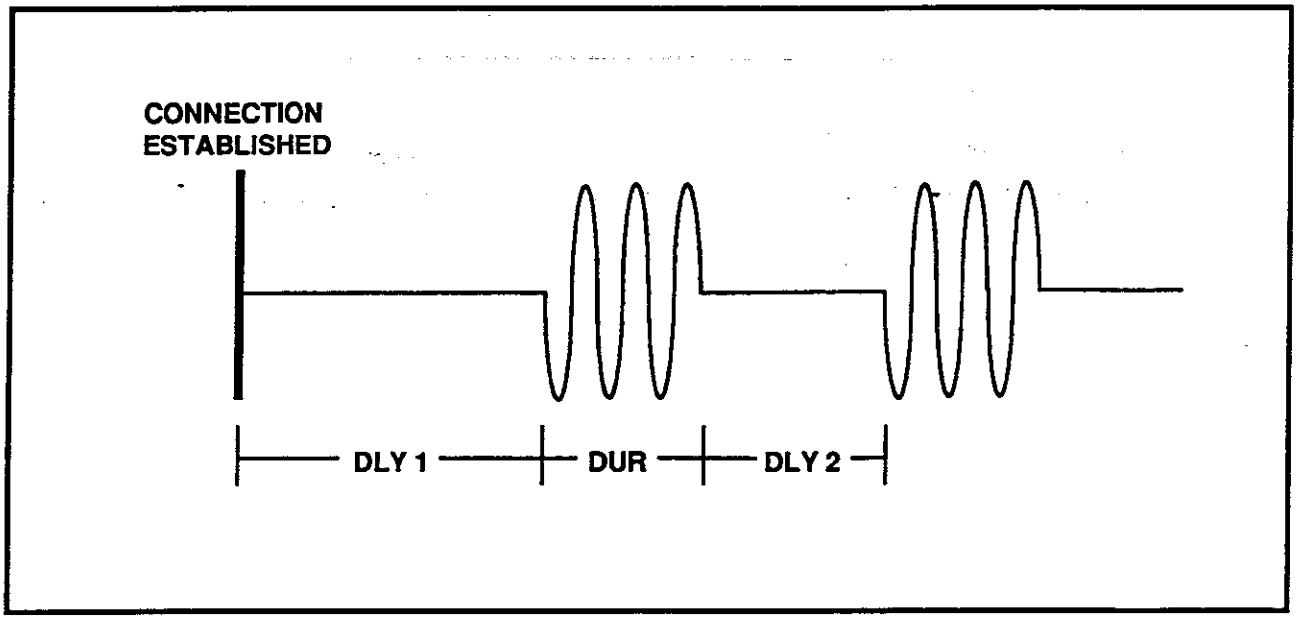
Operation From Meter Tones displayed in the Line Type Window:

Use: the **scroll** button to display On or OFF.
Press: the **Central Office** button to select the displayed characteristic
Results: if turned ON, display of the next submenu choice

Use: the **scroll** button to display the desired values
Press: the **Central Office** button to select
Results: display of the next submenu choice. Repeat procedure.

When the last number is completed,

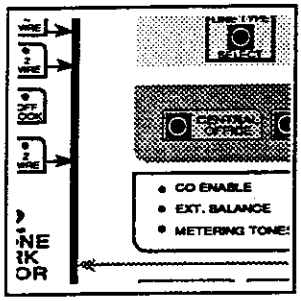
Press: **any other** button to exit the menu.



Metering Pulse Timing Diagram

Remote Command METER
MTONE

Purpose



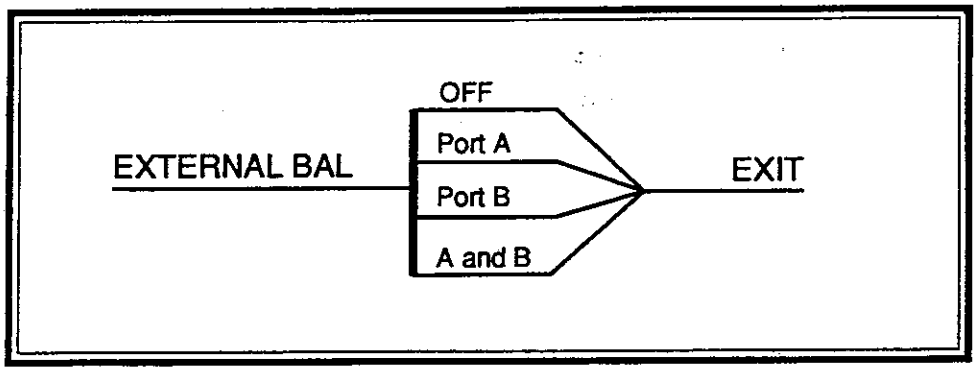
The External Balance feature allows the user to balance the Internal 2-Wire to 4-Wire Hybrid in the 5102. This is necessary when testing with Local Loops or when using a device with a Termination Impedance other than 600 or 900 ohms. A 600 or 900 ohm balance can be accomplished through internal strapping options, (see Section 10, Maintenance).

Connection for this feature is accomplished through the Rear Panel Connectors and Terminal Strip. (See the Rear Panel diagram, Sec. 3, page 18.) The 4-Wire signals at the hybrid are also provided on the rear panel for monitoring Trans-Hybrid loss. The signals are labeled:

TxA	Output signal on PORT A
RxA	Input signal on PORT A
TxB	Output signal on PORT B
RxB	Input signal on PORT B

Note

When using the terminal strip, all signals are referenced to ground as indicated on the rear panel. The balance connection is also referenced to ground, (i.e. connect balance for Port A from "BALA" to "GND" on terminal strip). When using the RJ11 connectors for balance, the balance impedance should be connected between pins 3 and 4 (Red and Green).



Menu Map

Central Office: External Bal/Submenu 1 - 4

Operation

Press:	the **Central Office** button
Use:	the **scroll** buttons to display External Balance
Press:	the **Central Office** button to select
Use:	the **scroll** buttons to display the desired feature
Press:	the **Central Office** button to select

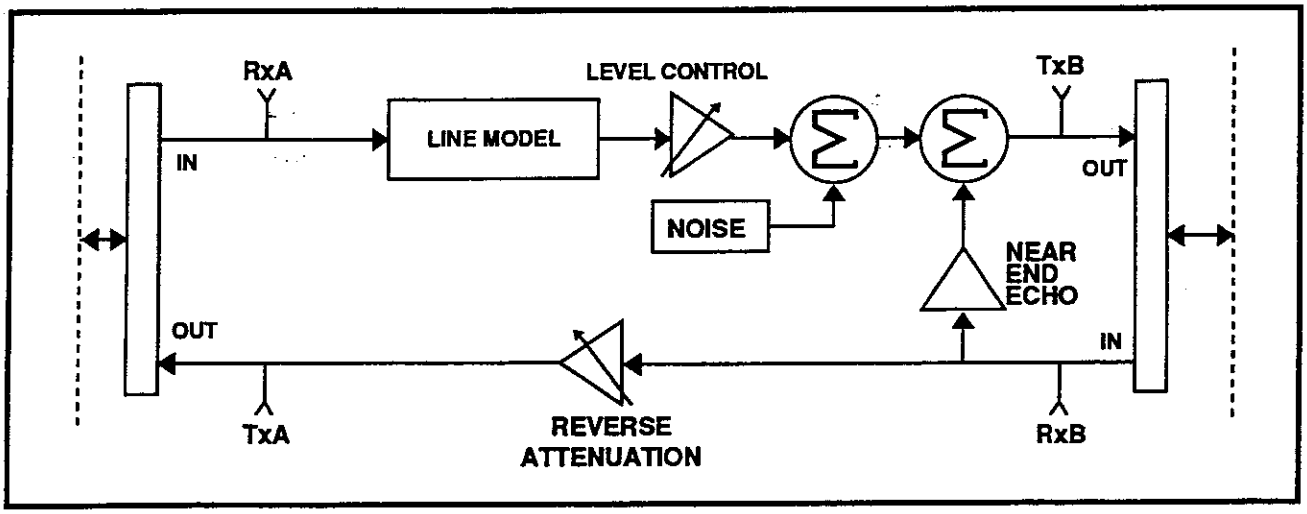
Submenu 1 - 4

1. Off - turns off the External Balance feature.
   LED Response - the External Balance LED is not lighted.

2. PORT A
   LED Response - the External Balance LED is lighted.

3. PORT B
   LED Response - the External Balance LED is lighted.

4. Both Ports A & B
   LED Response - the External Balance LED is lighted.

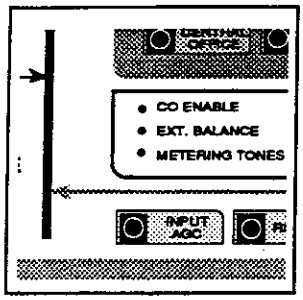


Signal Monitor Points

Remote Command XHYBRIDA
XHYBRIDB

INPUT AGC BUTTON

Purpose

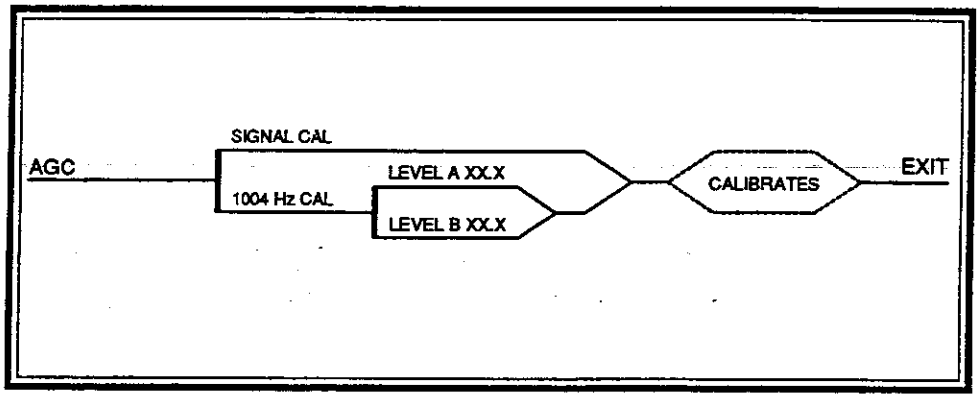


The Automatic Gain Control, (AGC) circuit is used to optimize the signal level from the Port A interface before any impairments are generated. This assures accurate and repeatable simulation. Once set, the gain is locked for the remainder of the test.

The 5102 provides two types of AGC. The first and most common is the signal cal" AGC. This method initiates a Power Measurement on the Port A interface. It then automatically sets the gain and calibrates the output power and the SNR settings.

The second type of AGC is available only in a bidirectional test system utilizing the PTT 5151. This approach provides a 1004 Hz sinusoid that is used to calibrate the 4-Wire impairments in both the forward and reverse paths.

For additional information, see Application Note 5102-03, Purpose and Operation of AGC.



Menu Map

AGC: Signal Cal/[Calibration]/Exit

. . . or . . .

AGC: 1004Hz Cal/Level/[Calibration]/Exit

Operation

For signal calibration:

Press:	the **Input AGC** button
Use:	the **scroll** buttons to display "Signal Cal"
Press:	the **Input AGC** button
Results:	the Line Type display will flash "Calibrating" until the new AGC gain value is determined and locked.

For 1004 Hz calibration: (for bidirectional only)
Set Preset Input level to desired amplitude for 1004 Hz tone.

Press: the **Input AGC** button
Use: the **scroll** buttons to display 1004 Hz calibration
Press: the **Input AGC** button
Result: display of the level to change for A or B
Use: the **scroll** buttons to display the desired levels
Press: the **Input AGC** button to record the displayed level

Note *The Line Type window displays a message whenever the input signal is out of range.*

Input > + 3dBm
Input < - 25 dBm

LED Response

Input AGC Select Button LED

Constantly ON - the gain is set and locked during a test.

FLASHING - indicates the 5102 is powered on
- an AGC attempt was not completed due to an out of range input.

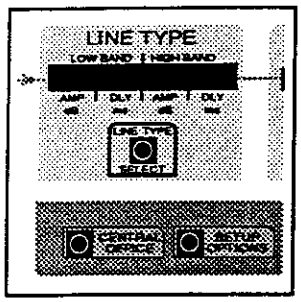
Constantly OFF - results from a RECALL of a previously stored configuration.
Reminder that the AGC has been restored from a previously saved configuration. Care should be exercised to ensure the configuration has not been modified since the save was executed.

Remote Command

AGC
TCAL
TGEN

LINE TYPE SELECT BUTTON

Purpose



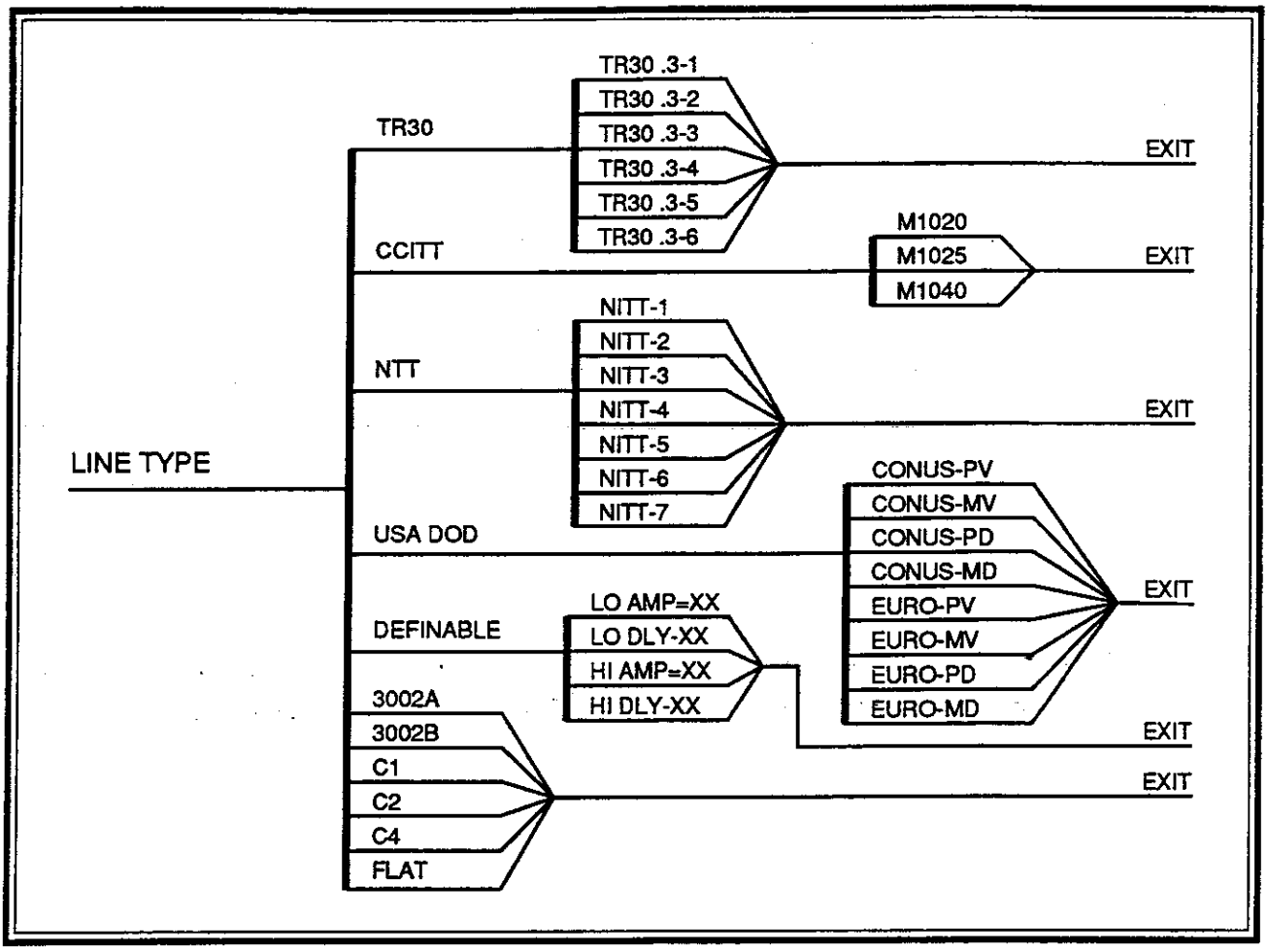
The Line Type Select button is used to select the line impairment (amplitude and envelope delay distortion) of the 5102. It contains 11 opening menu items and various submenus.

When the Line Type selections are completed, the Model 5102 implements the selected line model and proceeds with a sequence of related events. The input power on PORT A is measured and the system calibrates to implement the selected SNR (if enabled) and PWR-OUT (or ATTN). The absence of a valid input signal aborts the sequence and an out-of-range message is displayed. The display can be returned to the line model by pressing any select switch which uses the LINE TYPE display, such as the POWER MEASURE select button.

Graphic representation of Signal Impairments, Amplitude and Envelope Delay distortion are found in the Technical Reference section.

Submenu		Function
1. TR30	-	Contains submenus TR30.3-1 through TR30.3-6 corresponding to the EIA recommendation EIA 496A. (Selections for TSB 37 Lines 7-16 are also shown.)
2. CCITT	-	Contains submenus M.1020, M.1025 and M.1040 CCITT line model recommendations.
3. NTT	-	Contains submenus NTT-1 through NTT-7 corresponding to recommendations made by Nippon Telephone and Telegraph.
4. USA DOD	-	Contains seven submenus for Voice control corresponding to recommendations made by the United States Department of Defense.
5. DEFINABLE	-	Contains submenus for user definable Amplitude and Envelope Delay.
6. 3002A	-	Sets the standard line parameter at this value.
7. 3002B	-	Sets the standard line parameter at this value.
8. C1	-	Sets the standard line parameter at this value.
9. C2	-	Sets the standard line parameter at this value.
10. C4	-	Sets the standard line parameter at this value.
11. FLAT	-	Sets the standard line parameter at this value.

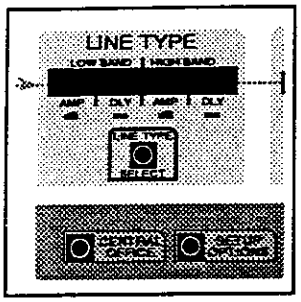
See Menu Diagram on the following page.



LINE TYPE SELECT - COMPLETE MENU

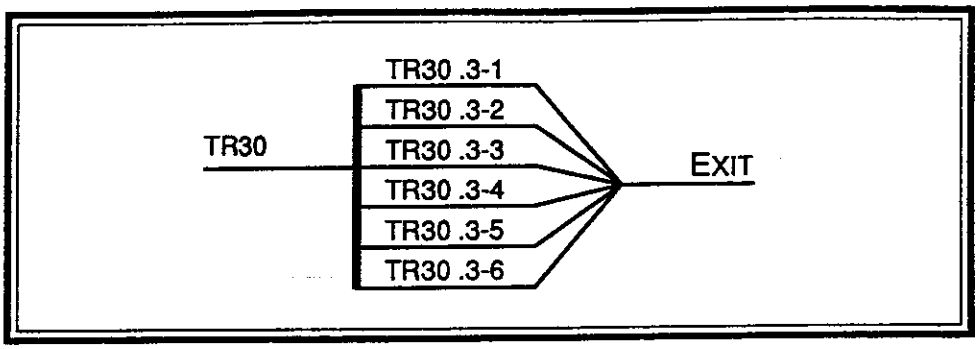
Menu flow is from left to right. When scrolling through submenu items with the **down scroll** button, they will wrap from bottom to top and repeat their order. A "back up" can be effected by using the **up scroll** button.

Purpose



This submenu item under the Line Type select button contains 6 available selections corresponding to recommendations made by the EIA recommendation EIA 496A.

To select TSB 37 lines 7 through 16, choose the appropriate 5102 line type given in the cross reference table.



Menu Map

Line Type Select: TR30/TR30.3-1through 3-6

Operation

At the Line Type submenu selection TR30

Press: the **Line Type Select** button
Use: the **scroll** buttons to display selections 1 through 6
Press: the **Line Type Select** button to select displayed choice
Results: the system performs calibration and blinks the selected line type in the line type window.
Press: the **Line Type Select** button to complete the operation.

Table 1: TSB 37 Cross Reference

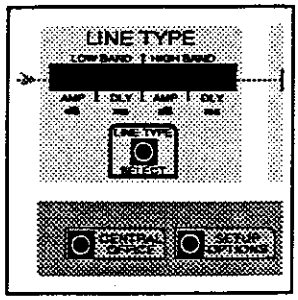
TSB 37 Cross Reference Table

TSB 37 Line	5102 Line Type Selection
7	TR30.3-1
8	TR30.3-6
9	TR30.3-6
10	TR30.3-1
11	TR30.3-1
12	TR30.3-4
13	TR30.3-3
14	TR30.3-6
15	TR30.3-1
16	TR30.3-1

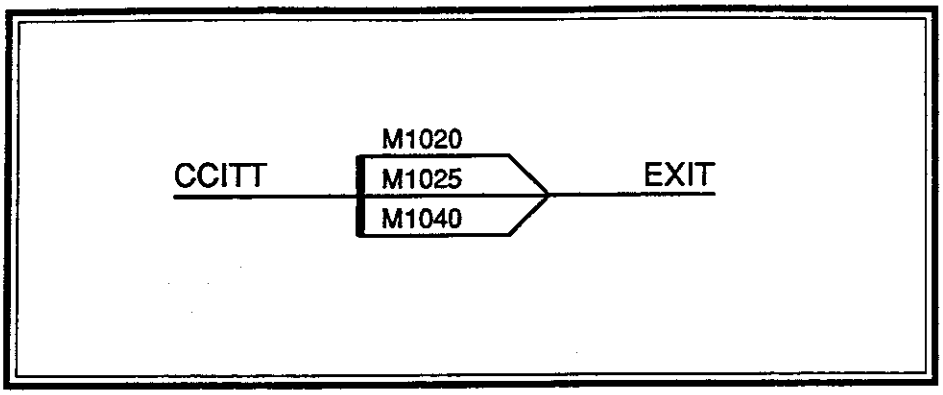
Remote Command

STD

Purpose



This submenu item under the Line Type select button contains 3 available selections corresponding to recommendations made by the Consultive Committee for International Telephone and Telegraph.



Menu Map

Line Type Select: CCITT/Selections 1-3

Operation

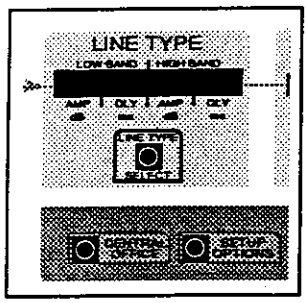
At the Line Type submenu selection CCITT

Press: the **Line Type Select** button
Use: the **scroll** buttons to display selections 1 through 3
Press: the **Line Type Select** button to select displayed choice
Results: the system performs calibration and displays selected line type in the line type window.

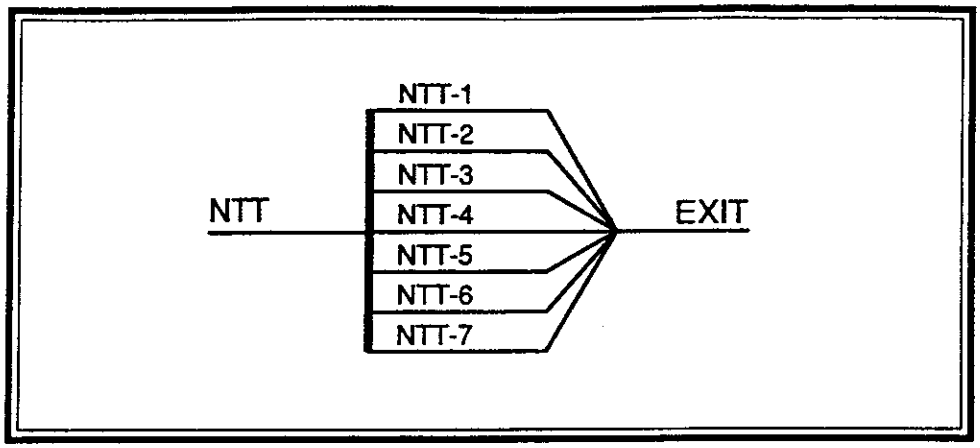
Remote Command

STD

Purpose



This submenu item under the Line Type select button contains 7 available selections corresponding to recommendations made by Nippon Telephone and Telegraph.



Menu Map

Line Type Select: NTT/Selections 1-7

Operation

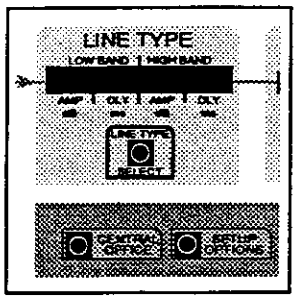
At the Line Type submenu selection NTT

Press: the **Line Type Select** button
Use: the **scroll** buttons to display selections 1 through 7
Press: the **Line Type Select** button to select displayed choice
Results: the system performs calibration and displays selected line type in the line type window.

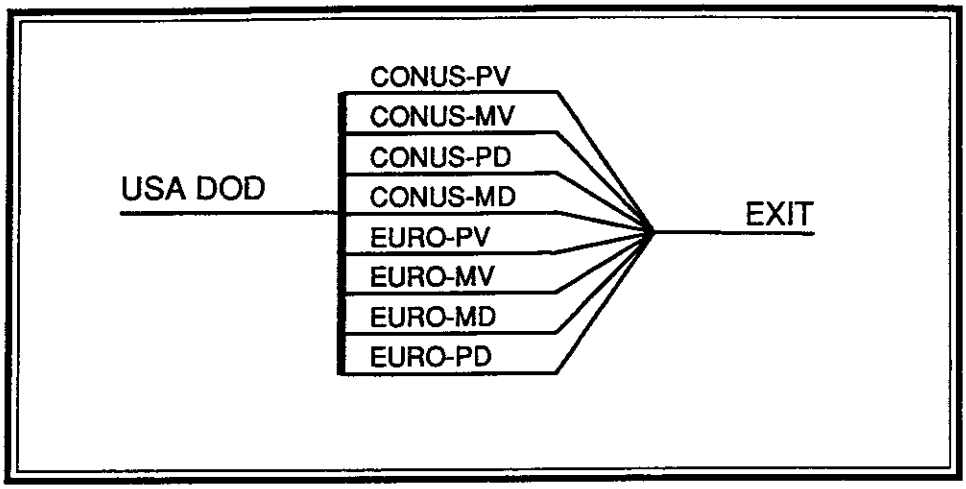
Remote Command

STD

Purpose



This submenu item under the Line Type select button contains 8 available selections corresponding to recommendations made by The United States Department of Defense.



Selections

1. CONUS PV - Poor Voice
2. CONUS MV - Mid Voice
3. CONUS PD - Poor Data
4. CONUS MD - Mid Data
5. EURO PV - Poor Voice
6. EURO MV - Mid Voice
7. EURO PD - Poor Data
8. EURO MD - Mid Data

Menu Map

Line Type Select: USA DOD/Selections 1-8

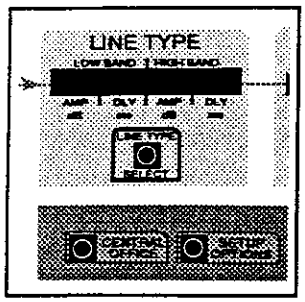
Operation

At the Line Type submenu selection USA DOD

Press: the **Line Type Select** button
Use: the **scroll** buttons to display selections 1 through 8
Press: the **Line Type Select** button to select displayed choice
Results: the system performs calibration and displays selected line type in the line type window.

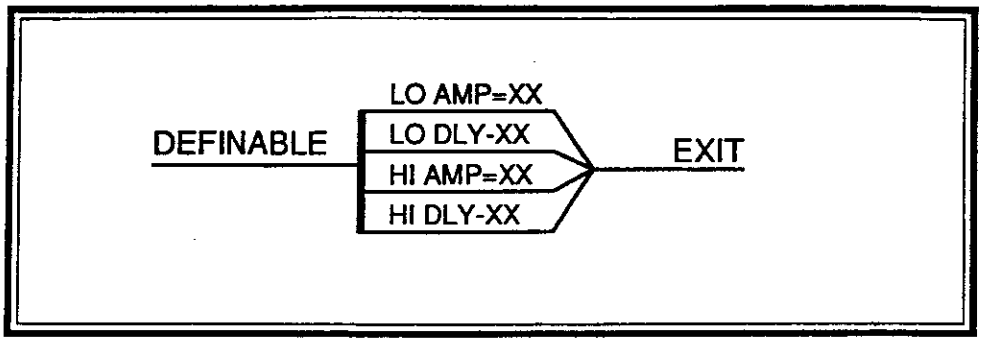
Remote Command STD

Purpose



This submenu item under the Line Type Select Button contains 4 submenu choices for custom defining the signal impairments.

For each selection there is a corresponding menu of 10 values for each of these four parameters, affording 10,000 combinations of the user definable lines. Graphic representations of these response curves are in the Technical Reference.



Selections

1. The Low End Amplitude at 600 Hz is enabled.
2. The Envelope Delay at 600 Hz is enabled.
3. The High End Amplitude at 3000 Hz is enabled.
4. The Envelope Delay at 3000 Hz is enabled.

Menu Map

Line Type Select: Definable/Selections 1-4

Operation

At the Line Type submenu selection DEFINABLE

Press:	the **Line Type Select** button
Results:	the display of the selected amplitudes and envelope delays with the number furthest to the left blinking, indicating it is active to be selected.
Use:	the **scroll** buttons to display desired number
Press:	the **Line Type Select** button to select the displayed number
Results:	the next number to the right is blinking indicating it is to be selected.
Use:	the **scroll** buttons to display numbers for selection

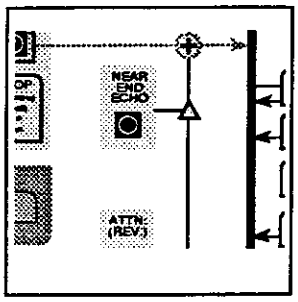
Continue in this manner until all four numbers are entered.

Results:	the system performs calibration and displays selected line type in the line type window.

Remote Command

DEF

Purpose



The Near End Echo button is used to enable the setting of the echo signal. The signal input to the Port B interface is attenuated and summed with the forward channel signal. It is then presented with the output signal to the Port B interface.

The range of setting is from 3 dB to 40 dB in 1 dB increments.

Operation

Press: the **Near End Echo** button
Results: the Line Type window displays NE ECHO=XXDB or OFF. Where XX is the value of the of the echo signal attenuator.

Use: the **scroll** buttons to display the desired setting
Press: the **Near End Echo** button to select.

To turn Near End Echo Off:

When using the "up" scroll button, the next display following 40 dB is "OFF".

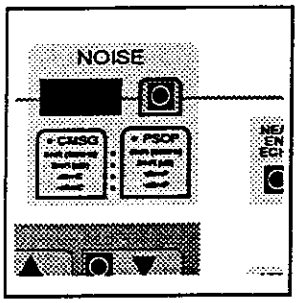
Press: the **Near End Echo** button to select.

Remote Command ECHO

NOISE BUTTON

Purpose

The Noise button is used to access the setting of the noise level.



The signal-to-noise ratio (SNR) is the ratio of the RMS signal power to the RMS noise power. It can be adjusted in 0.1 dB increments within a range of 0 dB to 50 dB. **This is constrained to a maximum SNR that is limited by a minimum generated noise power of -80 dBm in a 3000 Hz band from 300 to 3300 Hz. For example, if the output signal power is set to -50 dBm, the maximum SNR achievable is 30 dB.**

The Noise Generator characteristics are wide band, additive, Gaussian noise which is filtered by a second order, Butterworth, lowpass filter with a 3 dB cutoff frequency of 5000 Hz.

Note

The SNR setting is automatically updated when the output power is reduced to a level that causes the limit constraint to be exceeded.

Operation

First use the Setup Options/Noise Mode/ON to select the units for the Noise display. Selections for C-Message or Psophometric include:

C-Message	Psophometric	
SNR 3KHz	SNR 3KHz	- displays the Signal-to Noise Ratio in dB.
SNR CMSG	SNR PSOP	- displays the Signal-to-Noise Ratio in dB, weighted.
NOISE dBrnc	NOISE dBrnp	- displays the Signal-to-Noise Ratio in reference to -90 dBm.
NOISE dBmc	NOISE dBmp	- displays the absolute noise level in dBm, weighted.

Press: the **Noise Button**
Results: the NOISE display window shows three blanks.
Press: the UP **Scroll** button to begin selection.

At desired level
Press: the **Noise Button** to select

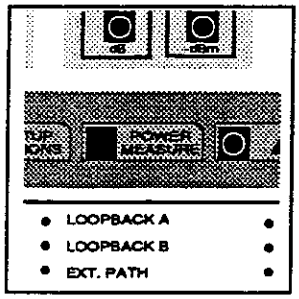
Restriction

The SNR setting cannot require a noise floor < -80 dBm.

Remote Command

SNR
NOISEC
NOISEP
SNRCMSG
SNRPSOP

Purpose



The Power Measure button is used to display in the Line Type Window the power the Network A and B interface input power and the forward channel output power level. To do so, the simulator must be in a state where all the selectable features are deselected.

Operation

Press and HOLD: the **Power Measure** button
While Using: **scroll** buttons to select:

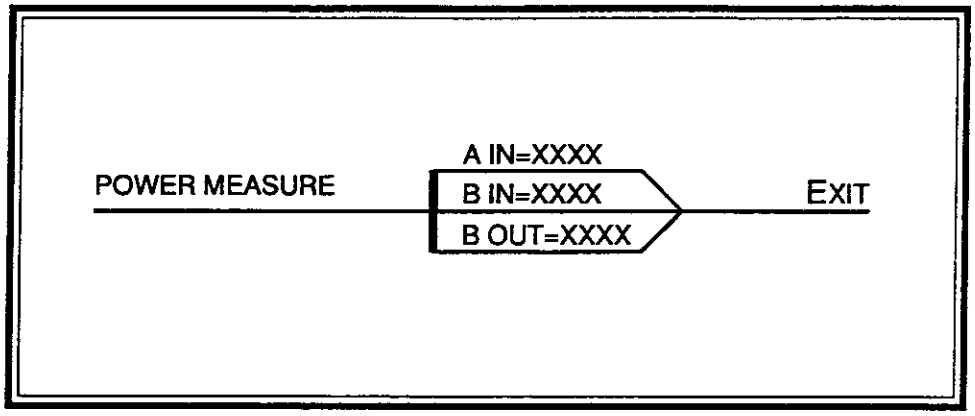
1) Network A Interface Input (A IN)
2) Network B Interface Input (B IN)
3) Forward Channel Output (B OUT)

Inputs that are out of range will be displayed as:

PWR A (or B) < - 40 dBm

or

PWR A (or B) > +3 dBm.

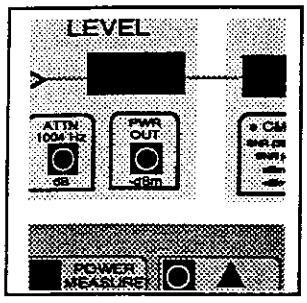


Remote Command PWRIN

POWER OUT BUTTON

Purpose

The Power Out button is used to set the Network B Interface output power.



The range of settings is from 0 dB to 55 dB in 0.1 dB steps. The range is restricted, in that the output power must be less than the input power on Network A Interface + 9.9 dBm. The output power is measured and adjusted to match the requested value each time a new LINE TYPE is selected and upon pressing the AGC button.

Operation

Press: the **Power Out** button
Results: the "level" begins to blink in the display window, as do the scroll LEDs.

Use: the **scroll** buttons to display the desired level
Press: the **Power Out** button at the desired level
Results: the selected level displays in the "level" display window.

Display Window Identification

The display window used by the Power Out is identified as LEVEL. This window is also used to display the Attn (1004 Hz) display. The lighted LED of either PWR Out or ATTN 1004 HZ indicates which is active.

Restrictions

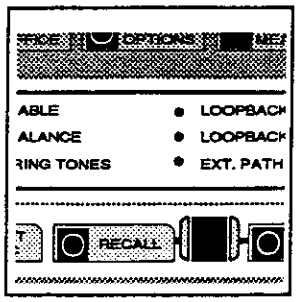
Power Out must always be $\leq$ 0 dBm

Power Out can not violate 9.9 dB of gain.

Remote Command

PWROUT

Purpose



The Recall button is the path to recalling (reusing) setup configurations that have been previously entered and saved with the SAVE Select button. It will not recall CO Select configurations saved in the Central Office submenu CO Modify/ Save. As many as 10 different configurations can be stored by using the features described in Save Select.

Operation

Press: the **Recall** button
Results: the window to the right of the Recall button displays selections 0-9.

Use: the **scroll** buttons to display the desired selection
Press: the **Recall** button.

To abort the procedure:

Press: **any other** Select button

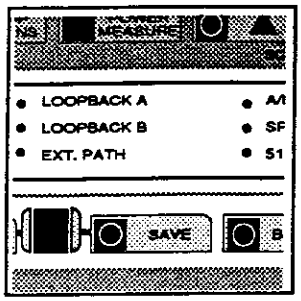
LEDs

When recalling a instrument configuration, after pressing, the Recall button LED is lit to indicated it is active, as are the scroll buttons.

Remote Command RCL

SAVE BUTTON

Purpose



Up to ten (10) instrument configurations can be saved for future reuse with the Recall Button. After the complete configuration is entered, it is saved with the **Save** Button. A memory location number between 0-9 will be selected for storage. To change or edit a configuration that has been previously saved, recall it by number, perform such modifications as needed, and then save again by the same number.

Operation

To create a new configuration:

After configuring the instrument to all the required parameters;

Press: the **Save** button
Results: the Save/Recall display will flash a memory location address

Use: the **scroll** keys to display the desired address
Press: the **Save** button to enter the current configuration into the memory at that address.

To Edit a previously saved configuration: (0-9)

With the Recall option, select the configuration to be modified;
Edit the configuration as desired.

Repeat the above process and save to the same location address number as was previously used.

LEDs

When electing to save, after pressing, the save button LED is lit to indicated it is active, as are the scroll buttons.

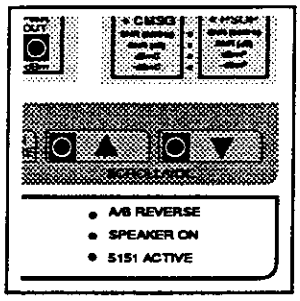
Restriction

Programmed Central Office Features must be saved using one of the "User" selections from the Central Office feature, submenu "Save". Using the general function "Save Button" will not store the CO parameters unless a specific User Central Office has been selected and is active.

Remote Command

SAVE

Purpose



The Scroll buttons are used to display menu choices, change the value of a selected item and control the speaker volume.

Activation of the Scroll buttons is totally dependent on other selections and will be indicated by the lighted LED in the center of each button.

Used to change menu displays:

When select switches are active (flashing) the Scroll button can be used to move forward (DOWN) or backward (UP) through the menu choices.

Used to control Speaker Volume:

If there are no select switches flashing, and the speaker has been enabled via the Setup Options Select button, the Scroll button can be used to increase (UP) or decrease (DOWN) the speaker volume.

Operation

When activated:

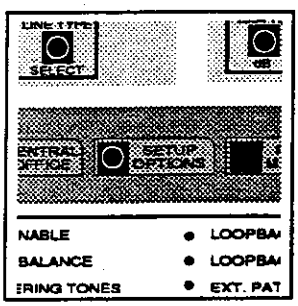
Press: the **up scroll** button to move in a "backward" direction to display menu choices, or to increase the speaker volume

Press: the **down scroll** button to move in a "forward" direction to display menu choices, or to increase the speaker volume

Remote Command VOL

SETUP OPTIONS BUTTON

Purpose



The Setup Options button is used to select the options available for five menu items and various submenus.

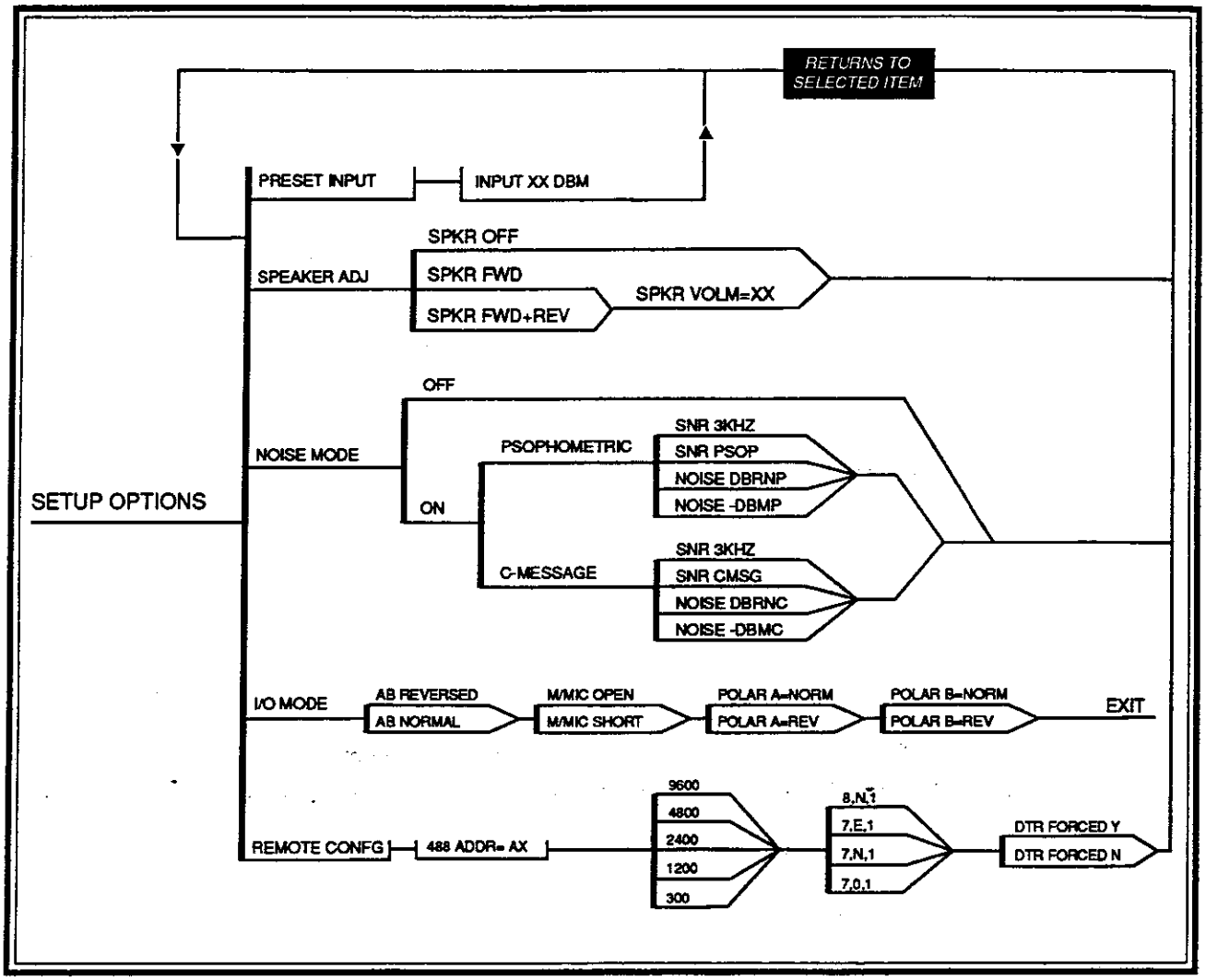
Submenu		Function
1. Preset INPUT	-	configure operation of the Input Automatic Gain Control
2. Speaker ADJ	-	set speaker OFF, or to set speaker to monitor the forward path or, the forward and reverse, path, adjusts volume
3. Noise Mode	-	determine the way the Signal-to-Noise ratio or additive noise level is displayed
4. I/O Mode	-	internal signal routing, i.e., reversal of Port A and Port B
5. Remote Configuration	-	configure remote ports for the IEEE-488 address and the RS-232C bit rate, stop bits and parity

Operation

Press: the **Setup Options** button
Use: the **scroll** button to display desired menu item
Press: the **Setup Options** button at desired menu item
Use: the **scroll** button to display desired submenu items
Press: the **Setup Options** button at desire menu item

. . . continue in same manner throughout menu items.

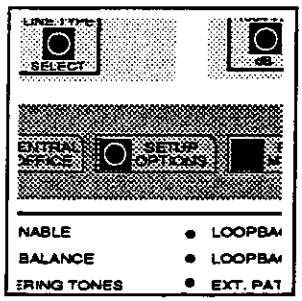
To Exit,
Press: **any other** button.



SETUP OPTIONS BUTTON - COMPLETE MENU

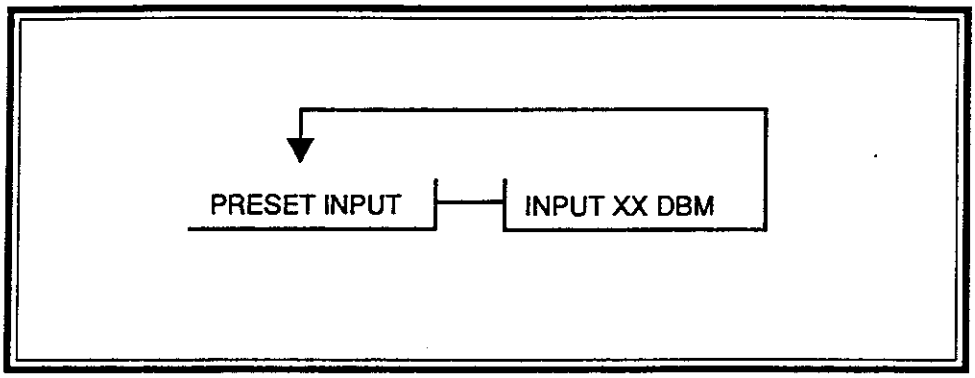
Menu flow is normally depicted from left to right. When scrolling through submenu items with the **down scroll** button, the flow will wrap from bottom to top and repeat the menu order. A "backup" can be effected by using the **up scroll** button.

Purpose



The Preset Input button is used to set the INPUT Automatic Gain Control (AGC) to correspond to a predefined input signal power. The 5102 will adjust the internal circuitry to optimize operation for the specific power that has been entered.

An alternative method to predefining the input level, is to use the AGC input button, which will signal the 5102 to measure the input signal and adjust the internal circuitry to correspond.



Menu Map

Setup Options: PRESET INP/Level = xx

Operation

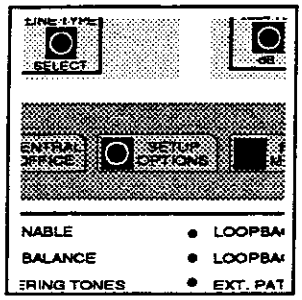
Set the Input Automatic Gain Control to any number between +01 and -25 dBm.

From Preset Input displayed in the Line Type Window:

Use:	the **scroll** buttons to display the desired numbers
Press:	the **Setup Options** button to select
Results:	the selection is recorded and the display returns to the Preset Input submenu
Press:	**any other** button to exit

Remote Command AGC

Purpose

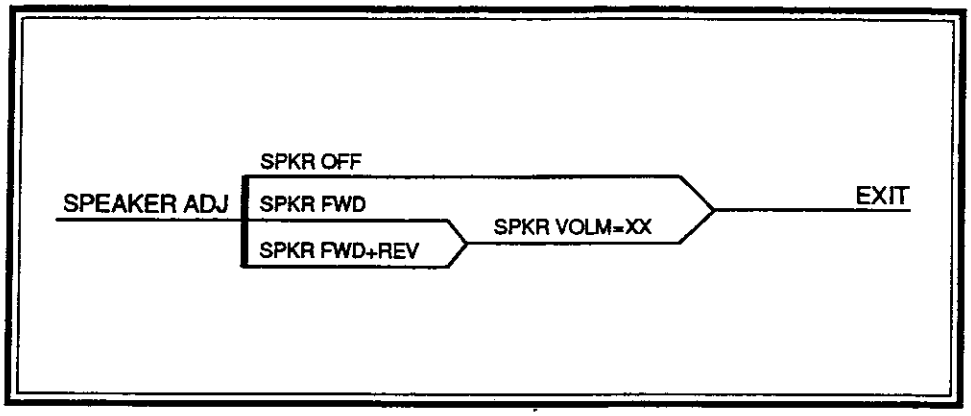


The Speaker ADJ is used to control the signals that are monitored by the speaker.

Adjustment to the internal speaker include:

- turn Off
- set to monitor the forward path audio signal
- set to monitor both the forward and reverse path audio signal
- volume adjust between levels 01 and 10.

The default setting is OFF. When the speaker is set to ON, the volume control also may be set after setting the speaker monitor forward, or monitor both forward and reverse.



Menu Map

Setup Options: Speaker ADJ/Submenu item/Volume

Operation

From Speaker ADJ displayed in the Line Type Window:

Press: the **Setup Options** button
Use: the **scroll** buttons to display Speaker OFF or one of the ON menu selections.

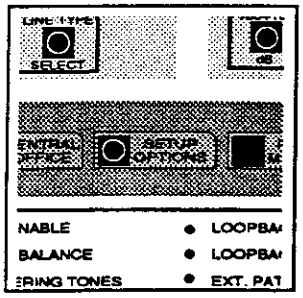
Press: the **Setup Options** button to select
Results: if OFF is selected, the system returns to the Speaker ADJ submenu.

If one of the ON submenus is selected, the system will display the speaker volume selection. Set the volume to any number between 01 and 10.

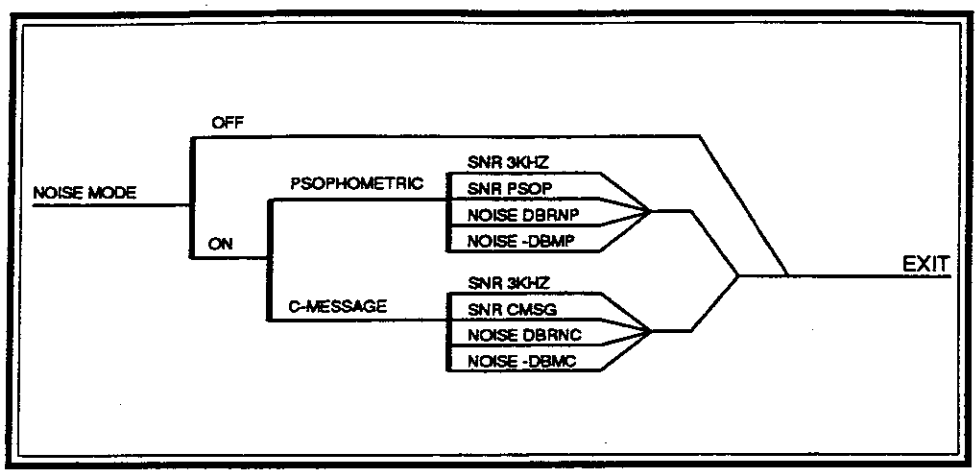
Use: the **scroll** button to display the volume adjustment
Press: the **Setup Options** button to select
Results: the system will return to the Speaker ADJ submenu.
Press: **any other** select button to exit

Remote Command SPKR

Purpose



The Noise Mode Submenu is used to turn Noise On/Off and when on, to change the way the Signal-to-Noise ratio or the additive noise level is displayed.



Menu Map

Setup Options: Noise Mode/ON/C-Message or Psophometric/Submenu

. . . or . . .

Setup Options: Noise Mode/OFF

Submenus 1 - 4 **For C-Message**

1. SNR 3 KHz - Displays the Signal-to-Noise Ratio in dB.
   LED Responses - The CMSG and the SNR(3KHz) are lighted

2. SNR CMSG - Displays the Signal-to-Noise Ratio in dB with C-Message weighted noise.
   LED Responses - The CMSG and the SNR(dB) are lighted.

3. NOISE dBrnC - Displays the absolute level of C-Message weighted noise in dBm.
   LED Responses - The CMSG and the dBrnC are lighted.

4. NOISE -dBmC - Displays the absolute level of C-Message weighted noise referenced to -90 dBm.
   LED Responses - The CMSG and the -dBmC are lighted.

The relationship between the possible operational modes is indicated by the following equations:

SNR 3KHz = SNRCMSG - 1.6

NOISE dBmC = NOISE dBrnC - 90

Submenus 1 - 4 **For Psophometric**

1. SNR (3 KHz) - Displays Signal-to-Noise Ratio in dB
   LED Responses - The PSOP and the SNR(3kHz) are lighted.

2. SNR PSOP - Displays the Signal-to Noise Ratio in dB with Psophometric weighted noise
   LED Responses - The PSOP and the SNR (dB) are lighted.

3. NOISE dBrnP - Displays the absolute level of Psophometric weighted noise in dBm.
   LED Responses - The PSOP and the dBrnp are lighted.

4. NOISE -dBmp - Displays the absolute level of noise Psophometric weighted referenced to -90 dBm
   LED Responses - The PSOP and the -dBmp are lighted.

The relationship between the possible operational modes is indicated by the following equations:

SNR 3KHz = SNR PSOP - 2.2
NOISE dBmp = NOISE dBrnp - 90

Operation

From Noise Mode displayed in the Line Type Window:

To turn Noise Mode OFF
Press: the **Setup Options** button
Use: the **scroll** buttons to display OFF
Press: the **Setup Options** button to select OFF
Results: the system will record the selection and exit the Setup Options menu

To turn Noise Mode ON
Press: the **Setup Options** button
Use: the **scroll** buttons to display ON
Press: the **Setup Options** button to select ON
Results: display of C-Message or Psophometric

Use: the **scroll** buttons to display the desired selection
Press: the **Setup Options** button to select C-Message or Psophometric
Results: the display of the submenu choices for Signal-to-Noise ratio in either C-Message or Psophometric

Use: the **scroll** buttons to display the desired ratio
Press: the **Setup Options** button to select

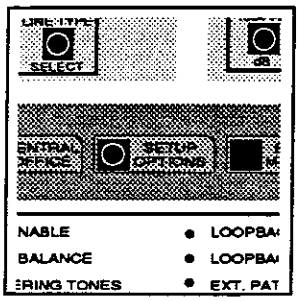
Results: the system will return to the submenu item, Noise Mode within Setup Options

Press: **any other** select button to exit

Remote Commands

SNR
SNRCMSG
SNRPSOP
NOISEC
NOISEP

Purpose

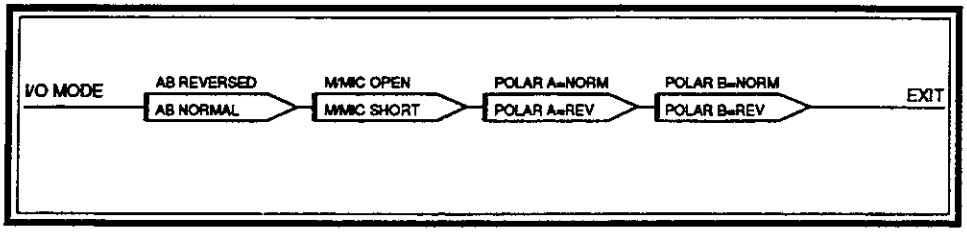


The Input/Output MODE is used to set the internal reversal of PORT A and PORT B. When the I/O is reversed, the signals input to Port A are routed through the reverse channel; the signals input at Port B are routed through the forward channel.

The condition of the MI and MIC TELCO leads of the PORT B 2-Wire connector may be programmed when in the 2-Wire RJ11 mode.

SHORT	=	causes a short circuit between the leads.
OPEN	=	creates an open circuit between the leads.

This signal pair is sometimes used to control the off hook relay of some types of modems.



Menu Map

Setup Options: I/O Mode/AB Reversed

. . . or . . .

Setup Options: I/O Mode/AB Normal

Select one: A/B Reversed
A/B Normal

Select one: M/MIC Open
M/MC=Short

Select one: Polar A=Normal
Polar A=REV

Select one: Polar B=Normal
Polar B=REV

Operation

From I/O/ Mode displayed in the Line Type Window

Press: the **Setup Options** button
Use: the **scroll** button to display A/B Normal or A/B Reversed
Press: the **Setup Options** button to select
Results: display of the next submenu choices

Use: the **scroll** button to display the desired choice
Press: the **Setup Options** button to select the displayed option

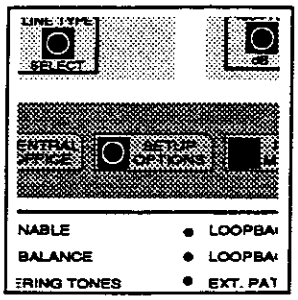
Continue in the same manner through the remainder of the submenus.

At the final menu selection
Press: the **Setup Options** button to exit

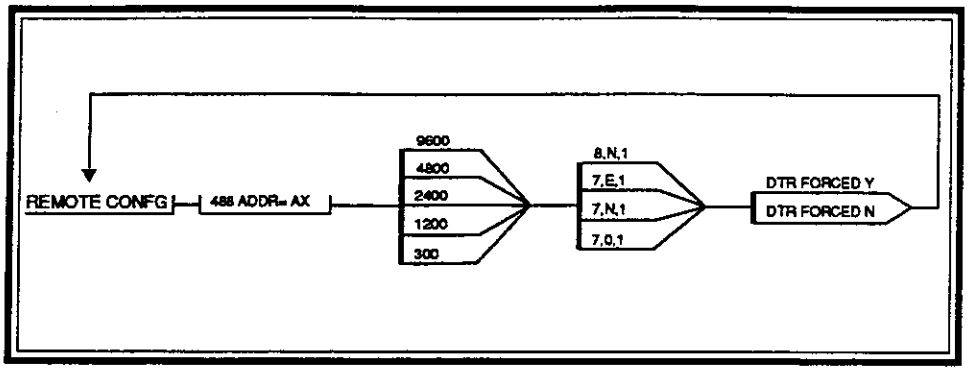
Remote Commands

LOOPA
LOOPB
MIMIC
PORTS

Purpose



The Remote Configuration is used to set the 5102's remote port for the IEEE-488 address and the RS-232C bit rate, stop bits and parity. There are thirty-one possible addresses for the IEEE-488 control port.



Menu Map

Setup Options: Remote Cfg/488 Addr=xx/xxxxBPS/Data=x,x,x/ DTR forced = Y or N

Note

Remote configuration can be set only by using the front panel operation and is not a part of any RECALL configuration. As with any other configuration set at the time of power down, the parameters will remain in place at the next power up.

During the following setup operation the process can be terminated at any point by pressing any select button other than SETUP OPTIONS. All communications port selections made prior to this type of termination are considered valid entries.

Operation

From Remote Configuration displayed in the Line Type Window:

Press: the **Setup Options** button to select
Results: the options are available to program the IEEE-488 address.

Use: the **scroll** button to display a new address from 31 possibilities
Press: the **Setup Options** to select the desired address
Results: the address is selected and the bit rate is displayed to select.

Use: the **scroll** button to display the desired bit rate from 300, 1200, 2400, 4800, and 9600 bps.
Press: the **Setup Options** button to select the displayed bit rate
Results: the bit rate is selected and the line type display will indicate the current RS-232C data format.

Use: the **scroll** buttons to display the desired format
Press: the **Setup Options** button to select
Results: the format is selected and the line type will indicate the current setting for the DTR (data terminal Ready) option.
Use: the **scroll** button to select:
Y = to force the DTR true to the 5102
N = to allow terminal control of DTR
Press: the **Setup Options** button
Results: The control port setup is complete.

Press: **any other** select button to exit

Table 2: RS-232C Selections for Remote Configuration

Format and Data Bits	10 bits/character (7 or 8 data bits)		
Mode:	Full Duplex		
Bit rate:	300, 1200, 2400, 4800, 9600		
Stop Bits	1 or 2		
Parity:	Even, Odd, or None		
Configuration:	**Bits/ch**	**Parity**	**Stop Bits**
	7	NO	2
	7	EVEN	1
	7	ODD	1
	8	NO	1

There are a number of LEDs on the front panel. In all cases, a lighted LED indicates activity. The operation buttons all have LEDs that are lighted whenever the operation is available for use, or "active".

The remainder of the LEDs, when lighted, indicate the current configuration of options controlled by the Central Office, the Setup Options, and the external equipment.

LED		Status Lighted Indication
CO ENABLE	-	the Central Office simulation has been enabled via the Central Office Button menu. (See CO Select .)
EXT BALANCE	-	indicates that Port A or Port B or both is in an external balance mode.
METERING TONES	-	metering tones present on the call originating port.
LOOPBACK A	-	Loopback A is selected via Central Office menu. (See Loopback.)
LOOPBACK B	-	Loopback B is selected via Central Office menu. (See Loopback.)
EXT. PATH	-	indicates external path active on RJ45 for forward and reverse path.
A/B REVERSE	-	the internal reversal of the Port A and Port B signal routing. (See I/O Mode).
SPEAKER ON	-	the internal speaker has been enabled, or "ON" via the Setup Options menu. (SeeSpeaker ADJ.)
5151 ACTIVE	-	presence of the PTT 5151 ECHO/ADVANCED IMPAIRMENT SIMULATOR. Indicates internal data signals are routed to 5151 expansion port.
488/232 ACTIVE	-	remote control activity through either the IEEE-488 or the RS-232C bus. Manual control can be disabled using the DKEY command, as indicated in the Remote Command Section.

Noise

PSOP	-	indicates PSOP weighting used in determining noise setting.
CMSG	-	indicates C-Message weighting used in determining noise setting.
SNR through dBmC	-	indicates the selected noise display mode by units as set via the Setup Options menu. (See Noise Mode.)

PORT A and PORT B

4 WIRE	-	Network Interface for Port A or B is set for 4 Wire.
2 WIRE	-	Network Interface for Port A or B is set for 2 Wire.
OFF HOOK	-	Network Interface station for Port A or B is Off Hook and loop current is active.

SECTION 4 - REMOTE OPERATIONS

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REMOTE CONFIGURATION

The 5102 is designed with the built-in option of configuration setup and control from an attached Personal Computer. The "Remote Configuration", submenu of the Setup Options button, is used to manually set the 5102's remote port for the IEEE-488 address and the RS-232C bit rate, stop bits and parity. There are thirty-one possible addresses for the IEEE-488 control port.

Note

Remote configuration can be set only by using the front panel operation and is not a part of any RECALL configuration. As with any other configuration set at the time of power down, the parameters will remain in place at the next power up.

During the following setup operation the process can be terminated at any point by pressing any select button other than SETUP OPTIONS. All communications port selections made prior to this termination are considered valid entries.

Menu Map

Setup Options: Remote Cfg/488 Addr=xx/xxxxBPS/Data=x,x,x/
DTR forced = Y or N

Operation

From Remote Configuration displayed in the Line Type Window:

Press:	the **Setup** Options button to select
Results:	the options are available to program the IEEE-488 address.
Use:	the **Scroll** button to display a new address from 31 possibilities
Press:	the **Setup Options** button to select the desired address
Results:	the address is selected and the bit rate is displayed for selection.
Use:	the **scroll** button to display the desired bit rate from 300, 1200, 2400, 4800, and 9600 bps.
Press:	the **Setup** Options button to select the displayed bit rate
Results:	the bit rate is selected and the line type display will indicate the current RS-232C data format.
Use:	the **scroll** buttons to display the desired format
Press:	the **Setup** Options button to select
Results:	the format is selected and the line type will indicate the current setting for the DTR (data terminal Ready) option.
Use:	the **scroll** button to select: Y = to force the DTR true to the 5102 N = to allow terminal control of DTR
Press:	the **Setup** Options button
Results:	The control port setup is complete.
Press:	**any other** select button to exit

Table 2: RS-232C Selections for Remote Configuration

Format and Data Bits	10 bits/character (7 or 8 data bits)		
Mode:	Full Duplex		
Bit Rate:	300, 1200, 2400, 4800, 9600		
Stop Bits:	1 or 2		
Parity:	Even, Odd, or None		
Configuration:	**Bits/ch**	**Parity**	**Stop Bits**
	7	NO	2
	7	EVEN	1
	7	ODD	1
	8	NO	1

REMOTE OPERATION

COMMUNICATION PORT SETUP

Remote Operation is configured by selections made with the Setup Options button.

The current control port configuration can be determined by selecting the Setup Options button and observing the Line Type window display. Remote Configuration setup is described in the two preceding pages as well as in Setup Options, Section 3 - Manual Operations.

Remote Commands

Command Format

CR - Carriage Return:
used to terminate all commands, using either the IEEE-488 or the RS-232C control port.

LF - Line Feed character:
use after the above Carriage Return is optional.

Blank Spaces - not acceptable when embedded in a command.
Acceptable only if preceding or following a command.

Backspace - use to erase incorrect entries for correction.

^X - (Ctrl X) use to erase an entire line for correction.

[ ] - the brackets are used in the manual only to identify placement of the optional arguments. They are not to be entered as part of the command.

Command Sample

BUSYT[,X1,X2,X3,X4,X5]
All letters are capitalized
Separated by commas, not spaces
The bracket character is used only to indicate an optional argument. It is not to be entered as a command character.

Responses from the 5102

Responses from the 5102 are terminated with a carriage return and a line feed character. For the IEEE-488, the EOL line is asserted when sending the line feed character.

When commands are being sent to the 5102 or responses are being received, the 488-232 LED will indicate activity by a blinking light.

The following conventions are followed when interpreting the commands;

Xn - Arguments (n is the argument number)
i.e., X1, X2, X3

[ ] - Optional arguments, if omitted the 5102 will return the present argument parameter value(s).

The responses from the 5102 after re-configuring the hardware according to the command given are:

OK - The command has been accepted and implemented
ERR x - Indicates an error message. Where X is the error, it can be located in the Command Response Table.

Additional responses to certain commands may appear to indicate abnormal conditions existing in the hardware. These responses are noted in the command summary.

Serial Polling

The 5102 supports serial polling operation. After a command has been sent, the 5102 processes the command and asserts the SRQ (Serial Request) line. At this point the controller should send the SPE (Serial Poll Enable) message and poll the device for a status response. This response will be 40 HEX. The controller can then proceed to send the SPD (Serial Poll Disable) message and read the 5102 data.

Note

The 5102 will also accept the command format previously used by the PTT 5101 and PTT 5100 to achieve backwards compatibility.

COMMAND	DESCRIPTION
BREAK	Polls the 5102 for the duration of the break period of the last pulse dial digit detected.
BUSYT	Set power, frequencies, and cadence of the Busy signal when composite power is set.
BUSY#	Set telephone number to access BUSY tone
CALLDLY	Sets connection delay time, i.e., the time between the called port offhook and the connection established.
CO	Set the central office dial features to be simulated.
CONNDLY	Sets connect delay time, i.e., the time between the last digit of the dialed number and the beginning of the ringing signal.
DIALDLY	Sets the dial tone delay, i.e., the time between off hook and dial tone.
DIGITS	Returns the Digits of the last telephone number dialed.
DURATION	Polls the 5102 for the duration of the last DTMF tone detected.
IDIALT	Set power, frequencies and ON times of International Dial tone.
IDIALT#	Set telephone number to access INTERNATIONAL DIAL tone.
INTERDIGIT	Polls the 5102 for the interdigit time of the last dialed digit.
LBACK	Set Loopback for PORT B or PORT A.
LUCRRENTA	Set Loop Current on PORT A in 2-Wire simulation.
LCURRENTB	Set Loop Current on PORT B in 2-Wire simulation.
LINE	Select Line Options.
LOOPA	Set Loop Current Polarity for PORT A.
LOOPB	Set Loop Current Polarity for PORT B.
MAKE	Polls the 5102 for the duration of the make period of the last pulse dial digit detected.
METER	Sets delays, amplitude and frequency of metering tones.
MIMIC	Controls the state of the MI and MIC leads for the B PORT in 2-Wire mode.

COMMAND	DESCRIPTION
MTONE	Turns Metering Tones ON or OFF
OFFHOOKDLY	Sets the onhook to offhook delay, i.e., the time between a port going offhook and the 5102 acknowledging it went offhook.
ONHOOKDLY	Sets the offhook to onhook delay, i.e., the time between a port going onhook and the 5102 acknowledging it went onhook.
PDIALT	Set power, frequencies, and cadence of the Primary Dial Tone when the composite power is set.
PDIALT#	Set telephone number to access a new Primary Dial Tone.
PORTS	Set Operation Mode of Ports A and B.
REORDERT	Set power, frequencies, and cadence of the Reorder signal when the composite power is set.
REORDER#	Set telephone number to access Reorder Tone.
RING	Ring the selected channel the designated number of times.
RINGBKT	Set composite power and frequencies of the Ringback signal.
RINGBK#	Set telephone number to access the ringback tone.
RINGINGT	Set RMS voltage level, frequencies and cadence of the Ring signal.
SDAILT	Set power, frequencies, and cadence of the Secondary Dial Tone.
SDIALT#	Set telephone number to access Secondary Dial Tone.
SPECIALT	Set power, frequencies, and cadence of the SPECIAL tone.
SPECIAL#	Set telephone number to access Special Information Tone.
SPEED#	Set telephone number for speed access from PORT A to B or PORT B to A.
TELNUMA	Set telephone number for network interface PORT A.
TELNUMB	Set telephone number for network interface PORT B.
USER	Save the current configuration of the Central Office Simulation
WARBLEDLY	Set the delay between off hook and warble tone.
WARBLET	Set power, frequencies, and cadence of the Warble signal when the composite power is set.

COMMAND	DESCRIPTION
WARBEL#	Set telephone number to access WARBLE tone.
XHYBRIDA	Turn external hybrid balance on or off for PORT A.
XHYBRIDB	Turn external hybrid balance on or off for PORT B.

NETWORK IMPAIRMENTS

A1004	Set output Attenuation referenced to 1004 Hz.
DEF	Set the user Definable lines.
ECHO	Set the 5102 Near End Echo Level.
NOISEC	Set Additive Noise Level.
NOISEP	Set Additive Noise Level. (CMSG)
PWROUT	Set Power Output on Channel B. (PSOP)
REVATT	REVATT
SNR	Set the 5102 output Signal to Noise Ratio (3KHz Noise).
SNRCMSG	Set the output Signal to Noise Ratio C-Message Weighted.
SNRPSOP	Set the 5102 output Signal to Noise Ration Psophometric Weighted.
STD	Select a 5102 line impairment.

CALIBRATION AND MEASUREMENT

AGC	Set the Automatic Gain Control for current input signal level.
PWRIN	Read Power Input to 5102 from A or B channel, or the B output power.
INLVL	Set the Automatic Gain Control for current input signal level.

(Continued)

COMMAND	DESCRIPTION
BKTOBK	Select the Back-to-Back unprocessed line connection (no impairments).
DCLEAR	Clears out the 5102 internal command and response buffers.
DKEY	Disables front panel Key entries.
EKEY	Enables front panel Key entries.
INIT	Initialize the 5102 to the normal power up condition.
RCL	Recall Stored 5102 setup and restore unit to recalled state.
RESET	Resets the 5102.
SAVE	Save the current state of the 5102 in selected address.
STATUS	Sends current Status of the 5102 to the controller.
VERSION	Query for the 5102 Software Version.
SPKR	Set the 5102 speaker mode.
VOL	Set the 5102 speaker volume.

APPLICABLE IN A BIDIRECTIONAL TEST SYSTEM USING THE 5151

PRESETA	Sets 1004 Hz tone level for Port A output.
PRESETB	Sets 1004 Hz tone level for Port B output.
TGEN	Generates 1004 Hz tone on Ports A or B.
TCAL	Automatically generates tone on Ports A + B and calibrates each 5151.

REMOTE OPERATION

FUNCTIONS AND COMMANDS

Description: Set output Attenuation referenced to 1004 Hz. **A1004 [,X1]**

Arguments: X1 = Output attenuation (dB)
Range: -9.9 to 55.0 dB
Step: 0.1 dB

Response: OK or ERR code

Response: 5102 will respond with present argument values **A1004**

Description: Set the Automatic Gain Control for current input signal level. **AGC**

Arguments: None

Response: OK, OVER, or UNDER

This is an output from the 5102 to indicate status. Response times will vary depending on input signal levels and will generally range from 5-10 seconds.

OK: Input signal between +3.0 and -25.0 dBm
OVER: Input signal is greater than +3.0 dBm
UNDER: Input signal is less than -25.0 dBm

When Line Dial Feature is enabled and Channel A or Channel B is receiving dial tone, the response to AGC command is ERR 5 indicating invalid mode of operation.

Description: Select the Back-to-Back unprocessed line connection (no impairments). **BKTOBK [,X1]**

Arguments: X1 = ON, Turns back-to-back mode on.
= OFF, Turns back-to-back mode off.

Response: OK or ERR code

Response: 5102 will respond with present argument value(s) **BKTOBK**

Restriction: *2-Wire to 4-Wire modes are not supported in Back-to-Back.*

COMMAND		SUMMARY
BREAK	Description:	Polls the 5102 for the duration of the break period of the last pulse dial digit detected.
	Arguments;	None
	Response:	Value in milliseconds or ERR code

BUSYT[,X1,X2,X3,X4,X5] Description: Set power, frequencies, and cadence of the Busy signal when composite power is set.

OR

BUSYT[,,X2,X3,X4,X5,X6, X7] Description: Set power, frequencies and cadence of the Busy signal when each signal power is set.

Arguments:

X1 = Composite power of Busy
Nominal: See Technical Reference Section
Range: 0.0 to -50.0 dBm
Step: 0.1 dB

X2 = Frequency #1
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X3 = Frequency #2
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X4 = Signal On Time for BUSY
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X5 = Signal OFF Time for BUSY
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

(Continued)

X6 = Power, in dBm of Freq. #1 — **BUSYT[,X2,X3,X4,X5,X6,X7]** (Cont.)
Range: -3.0 to -53.0 dBm
Step: 0.1 dB

X7 = Power, in dBm of Freq. #2
Range: -3.0 to -53.0 dBm
Step: 0.1 dB

Response: OK or ERR code

Restores all argument values to nominal state — **BUSYT,RST**

Response: 5102 will respond with present argument value(s) — **BUSYT**

Description: Set telephone number to access BUSY tone. — **BUSY#[,X1]**

Arguments: X1= 1 to 20 digit number

Restrictions: *Do not program any two of the programmable central office numbers to the same value.*

The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.

Response: 5102 will respond with present argument value(s) — **BUSY#**

Description: Sets connection delay time, i.e., the time between the called port off hook and the connection established. — **CALLDLY[,X1]**

Arguments: X1 = Delay in seconds
Nominal: 00.1 sec
Range: 00.0 to 25.5 sec
Step: 00.1 sec

Response: OK or ERR code

CALLDLY

Response: 5102 will respond with present argument value(s)

COMMAND		SUMMARY
CO[,X1]	Description:	Set the central office dial features to be simulated
	Arguments:	X1 = AUSTRALIA, BELGIUM, CANADA, FRANCE, IRELAND, JAPAN, KOREA, NETHER, NORWAY, SING, SWEDEN, SWITZ, TAIWAN, UK, USA, GERMANY, USER 0, USER 1, USER 2, USER 3, USER 4
		X1 = OFF (Disables Central Office Simulation)
	Response:	OK or ERR code
	Note:	*The nominal values for these central offices are shown in summary form in Section 6, Technical Reference.*
CO	Response:	5102 will respond with present argument value(s)
	Restriction:	*To enable Central Office, the simulator must have loop current ≥ 10mA , and be operating in a 2-Wire mode.*
CONNDLY[,X1]	Description:	Sets connection delay time, i.e., the time between the last digit of the dialed number and beginning of the ringing signal.
	Arguments:	X1 = Delay in seconds Nominal: 00.1 sec Range: 00.0 to 25.5 sec Step: 00.1 sec
	Response:	OK or ERR code
CONNDLY	Response:	5102 will respond with present argument value(s)
DCLEAR	Description:	Clears out the 5102 internal command and response buffers.
	Arguments:	None
	Response:	OK or ERR code

Description: Set the user definable lines **DEF[,X1,X2,X3,X4]**

Arguments: X1 = Low frequency Amplitude Distortion (dB)
Range: -25, -20, -15, -10, -6, -3, 0, +3, +6, +10

X2 = Low frequency Envelope Delay Distortion (msec)
Range: 0.0, .25, .50, .75, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0

X3 = High Frequency Amplitude Distortion (dB)
Range: -25, -20, -15, -10, -6, -3, 0, +3, +6, +10

X2 = High frequency Envelope Delay Distortion (msec)
Range: 0.0, .25, .50, .75, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0

Response: UNDER, input signal < -25dBm
OVER, input signal > +3dBm

Response: 5102 will respond with present argument value(s) **DEF**

Description: Sets the dial tone delay, i.e., the time between off hook and dial tone. **DIALDLY[,X1]**

Arguments: X1 = Delay in seconds
Nominal: 00.1 sec
Range: 00.0 to 25.5 sec
Step: 00.1 sec

Response: OK or ERR code

Response: 5102 will respond with present argument value(s) **DIALDLY**

Description: Returns the Digits of the last telephone number dialed. **DIGITS**

Arguments: None

Response: 5102 will respond with the last valid digit(s) dialed or with a space (20H) following the DIGITS,RST command

Resets the digits buffer to contain the hex code for a space (20H) **DIGITS,RST**

Note: *STATUS command reports if dialing was DTMF or PULSE*

COMMAND	SUMMARY	
DKEY	Description:	Disables front panel Key entries
	Arguments:	None
	Response:	OK or ERR code
DURATION	Description:	Polls the 5102 for the duration of the last DTMF tone detected.
	Arguments:	None
	Response:	Value in milliseconds or ERR code
ECHO[,X1]	Description:	Set the 5102 Near End Echo Level.
	Arguments:	X1 = Level Relative (dB) Range: OFF or 3 to 40 dB (OFF turns echo off) Step: 1 dB
	Response:	OK or ERR code
ECHO	Response:	5102 will respond with present argument value(s)
EKEY	Description:	Enables front panel Key entries
	Arguments:	None
	Response:	OK or ERR Code
IDIALT[,X1,X2,X3,X4,X5]	Description:	Set power, frequencies, and ON times of international dial tone.
	Note:	*The International dial tone is a periodic sequence composed of equal periods of three different frequencies without an off period.*

Arguments: X1 = Power of INTDT signal — **IDIALT[,X1,X2,X3,X4,X5]** (Cont.)
Nominal: -12.0 dBm
Range: 0.0 to -50.0 dBm
Step: 0.1 dB

X2 = Frequency #1
Nominal: 900 Hz
Range: 0 to 3000Hz
Step: 1Hz

X3 = Frequency #2
Nominal: 1020 Hz
Range: 0 to 3000 Hz
Step: 1 Hz

X4 = Frequency #3
Nominal: 1140 Hz
Range: 0 to 3000 Hz
Step: 1 Hz

X5 = Signal On Time for each tone
Nominal: 0.40 seconds
Range: 0.00 to 12.75 sec
Step: 00.05 sec

Response: OK or ERR code

Description: Restores all argument values to nominal state — **IDIALT,RST**

Response: 5102 will respond with present argument value(s) — **IDIALT**

Description: Set telephone number to access INTERNATIONAL DIAL tone. — **IDIALT#[,X1]**

Arguments: X1 = 1 to 20 digit number

Restrictions: *Do not program any two of the programmable central office numbers to the same value*

The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.

Response: 5102 will respond with present argument value(s) — **IDIALT#**

INIT	Description:	Initializes 5102 to the normal power up condition.
	Arguments:	None
	Response:	None
INLVL[,X1]	Description:	Set the Automatic Gain Control for current input signal level.
	Arguments:	X1 = Desired level for AGC setting. Range: +3 to -25 (dBm) Step: 1 (dB)
	Response:	OK or ERR code.
INLVL	Response:	5102 will return the present argument value(s)
	This command requests the 5102 to assume an input level at PORT A as defined by X1 for the purpose of adjusting the input gain setting.	
INTERDIGIT	Description:	Polls the 5102 for the interdigit time of the last dialed digit.
	Arguments:	None
	Response:	Value in milliseconds or ERR code
LBACK[,X1]	Description:	Set Loopback for PORT B or PORT A.
	Arguments:	X1 = OFF Normal Mode A PORT A in Loopback B PORT B in Loopback
	Response:	OK or ERR code
LBACK	Response:	5102 will respond with present argument value(s)
	Note:	*Selecting A or B will disable the central office simulator.*

Description: Set Loop Current on PORT A in 2-Wire simulation. **LCURRENTA[,X1]**

Arguments: X1 = Loop Current
Range: 0 to 120 mA *
Values: 00, and 10 to 120 mA
Step: 1 mA

Response: OK or ERR code

Response: 5102 will respond with present argument value(s) **LCURRENTA**

Note: **** Loop Current :*** *The 5102 will provide the designated amount of loop current regardless of the load connected to the 5102 Port. However, the loop current will be limited from the 5102 if the requested current into the desired load device would create more than a 44 volt drop across the load device. When testing with local loops, loop current should be set ≤25mA, (due to large dc resistance of local loops).*

Description: Set Loop Current on PORT B in 2-Wire simulation. **LCURRENTB[,X1]**

Arguments: X1 = Loop Current
Range: 0 to 120 mA *
Values: 00, and 10 to 120 mA
Step: 1 mA

Response: OK or ERR code

Response: 5102 will respond with present argument value(s) **LCURRENTB**

Note: **** Loop Current :*** *The 5102 will provide the designated amount of loop current regardless of the load connected to the 5102 Port. However, the loop current will be limited from the 5102 if the requested current Into the desired load device would create more than a 44 volt drop across the load device. When testing with local loops, loop current should be set ≤25mA, (due to large dc resistance of local loops).*

LINE[,X1]	Description:	Select Line Options.
	Arguments:	X1 = 2WRJ11 2WRJ45 4WRJ45 2WA4WB 4WA2WB 2WEXTPATH 2WBIDIRECT
	Response:	OK or ERR code
LINE	Response:	5102 will respond with present argument value(s)
LOOPA[,X1]	Description:	Set Loop Current Polarity for PORT A.
	Arguments:	X1 = NORM Normal Mode REV Reversed Mode
	Response:	OK or ERR code
LOOPA	Response:	5102 will respond with present argument value(s)
LOOPB[,X1]	Description:	Set Loop Current Polarity for PORT B.
	Arguments:	X1 = NORM Normal Mode REV Reversed Mode
	Response:	OK or ERR code
LOOPB	Response:	5102 will respond with present argument value(s)
MAKE	Description:	Polls the 5102 for the duration of the make period of the last pulse dial digit detected.
	Arguments:	None
	Response:	Value in milliseconds or ERR code

Description: Sets delays, amplitude and frequency of metering tones. **METER[,X1,X2,X3,X4,X5]**

Arguments: X1 = Initial Delay
Nominal: 0.0 seconds
Range: 0.0 to 25.5 sec
Step: 0.1 sec

X2 = Repetition Delay
Nominal: 4.0 seconds
Range: 0.0 to 25.5 sec
Step: 0.1 sec

X3 = Pulse Frequency
Nominal: 12.0 KHz
Range: 0.1 to 25.4 KHz
Step: 0.1 KHz

X4 = Pulse Length
Nominal: 120 ms
Range: 10 to 1000 ms
Step: 10 ms

X5 = Pulse Amplitude
Nominal: 2.10 Vrms *
Range: 0.05 to 6.00 Vrms
Step: 0.05 Vrms

Response OK or ERR code

Note: *Use MTONE command to enable or disable Metering Tones.*

Response: 5102 will respond with present argument value(s) **METER**

* Vrms into 600Ω load

Description: Controls the state of the MI and MIC leads for the B PORT in 2-Wire RJ11 mode. **MIMIC[,X1]**

Arguments: OPEN - MI and MIC not connected
CLOSED - MI and MIC leads shorted

Response: OK or ERR code

Response: 5102 provides present state. **MIMIC**

MTONE[,X1]

Description: Turns Metering Tones ON or OFF.

Arguments: ON = enables Metering Tones
OFF = disables Metering Tones

Response: OK or ERR code

MTONE

Response: 5102 provides present state.

NOISEC[,X1]

Description: Set Additive Noise Level.

If X1 is positive, the output setting is assumed to be in dBrnC. If X1 is zero or negative, the output setting is assumed to be in -dBmC.

X1 ≤ 0 Arguments: X1 = Value of Noise
Range: OFF, -1.6 to -81.6 dBmC
Step: 0.1 dBmC

X1 > 0 Arguments: X1 = Value of Noise
Range: OFF, 8.4 to 88.4 dBrnC
Step: 0.1 dBrnC

Response: OK or ERR code

NOISEC

Response: 5102 provides present value(s)

NOISEP[,X1]

Description: Set Additive Noise Level.

If X1 is positive, the output setting is assumed to be in dBrnp. If X1 is zero or negative, the output setting is assumed to be in -dBmp.

X1 ≤ 0 Arguments: X1 = Value of Noise
Range: OFF, -2.2 to -82.2 dBmp
Step: 0.1 dBmp

X1 > 0 Arguments: X1 = Value of Noise
Range: OFF, 7.8 to 87.8 dBrnp
Step: 0.1 dBrnp

Response: OK or ERR code

NOISEP

Response: 5102 provides present value(s)

SUMMARY		COMMAND
Description:	Sets the onhook to offhook delay; i.e., the time between a port going offhook and the 5102 acknowledging it went offhook.	**OFFHOOKDLY[,X1]**
Arguments:	X1 = Initial Delay Nominal: 0.7 seconds Range: 0.0 to 2.55 sec Step: 0.01 sec	
Response:	OK or ERR code	
Response:	5102 provides present value(s)	**OFFHOOKDLY**
Description:	Sets the offhook to onhook delay; i.e., the time between a port going onhook and the 5102 acknowledging it went onhook.	**ONHOOKDLY[,X1]**
Arguments:	X1 = Initial Delay Nominal: 0.7 seconds Range: 0.0 to 2.55 sec Step: 0.01 sec	
Response:	OK or ERR code	
Response:	5102 provides present value(s)	**ONHOOKDLY**
Description:	Set power, frequencies, and cadence of the Primary Dial Tone when the composite power is set.	**PDIALT[,X1,X2,X3,X4,X5, X6,X7,X8,X9]**
Description:	Set power, frequencies, and cadence of the Primary Dial Tone when each signal power is set.	**PDIALT[,X2,X3,X4,X5,X6, X7,X8,X9,X10,X11]**
Arguments:	X1 = Composite Power of Primary Dial Tone Nominal: See Technical Reference Section Range: 0.0 to -50.0 dBm Step: 0.1 dB	
	X2 = Frequency #1 Nominal: See Technical Reference Section Range: 0 to 3000 Hz Step: 1Hz	

(Continued)

PDIALT[,X1,X2,X3,X4,X5, X6,X7,X8,X9] (Cont.)

PDIALT[,,X2,X3,X4,X5,X6, X7,X8,X9,X10,X11] (Cont.)

X3 = Frequency #2
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X4 = Signal On Time Number 1
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X5 = Signal Off Time Number 1
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X6 = Signal On Time Number 2
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X7 = Signal Off Time Number 2
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X8 = Signal On Time Number 3
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X9 = Signal Off Time Number 3
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X10 = Power of Tone #1 in the Primary Dial Tone
Range: -3.0 to -53.0 dBm
Step: 0.1 dB

X11 = Power of Tone #2 in the Primary Dial Tone
Range: -3.0 to -53.0 dBm
Step: 0.1 dB

Response: OK or ERR code

PDIALT,RST Description: Restores all argument values to nominal state

PDIALT Response: 5102 will respond with present argument value(s)

SUMMARY	COMMAND

Description: Set telephone number to access a new Primary Dial Tone. **PDIALT#[,X1]**

Arguments: X1 = 1 to 20 digit number

Restrictions: *Do not program any two of the programmable central office numbers to the same value.*
The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.

Response: 5102 will respond with present argument value(s) **PDIALT#**

Description: Set Operation Mode of Ports A and B. **PORTS[,X1]**

Arguments: X1 = NORM Normal Mode
REV Ports Reversed

Response: OK or ERR code

Response: 5102 will respond with present argument value(s) **PORTS**

Description: Sets the amplitude of the 1004 Hz calibration tone on the Port A Output (forward path calibration tone). **PRESETA[,X1]**

Arguments: X1 = Amplitude (dBm) (default = -9.5)
Range: -25.0 to +3.0 dBm
Step: 0.1 dB

Restriction: *This command can only be used in a bidirectional test mode in conjunction with two PTT 5151s.*

Response: OK or ERR code

Response: 5102 will respond with present argument value(s) **PRESETA**

PRESETB[,X1]

Description: Sets the amplitude of the 1004 Hz calibration tone on the Port B Output (reverse path calibration tone).

Arguments: X1 = Amplitude (dBm) (default = -9.5)
Range: -25.0 to +3.0 dBm
Step: 0.1 dB

Restriction: *This command can only be used in a bidirectional test mode in conjunction with two PTT 5151s.*

Response: OK or ERR code

PRESETB

Response: 5102 will respond with present argument value(s)

PWRIN[,X1]

Description: Read Power Input to 5102 from A or B Port or Power Output on B Port

Arguments: X1 = A, B, out
Range: +3.00 to -55.00 dBm
Resolution: 0.01 dB

Response: Input Power (RMS) for Channel A or B or output for Channel B

PWROUT[,X1]

Description: Set Power Output on Channel B.

Arguments: X1 = Value of output power
Range: 0.00 to -55.0 dBm
Step: 0.1 dB

Response: OK or ERR code

PWROUT

Response: 5102 will respond with present argument value(s)

Restrictions: *Power Out must always be $\leq$ 0 dBm.*
Power Out can not violate 9.9 dB of gain.

SUMMARY	COMMAND
Description: Recall stored 5102 setup and restore unit to recalled state.	**RCL[,X1]**
Arguments: X1 = Address of stored setup Range: 0 to 9	
Response: OK or ERR code	
Response: 5102 will respond with last recalled state	**RCL**
Note: *The RCL command restores the configuration that was selected when the SAVE command was executed.*	

Description: Set power, frequencies, and cadence of the Reorder signal when the composite power is set. **REORDERT[,X1,X2,X3,X4, X5,X6,X7,X8,X9]**

Description: Set power, frequencies, and cadence of the Reorder signal when each composite power is set. **REORDERT[,,X2,X3,X4,X5, X6,X7,X8,X9,X10,X11]**

Arguments:

X1 = Composite Power of the REORDER signal
Nominal: See Technical Reference Section
Range: 0.0 to -50.0 dBm
Step: 0.1 dB

X2 = Frequency #1
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 0.1 dB

X3 = Frequency #2
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X4 = Signal On Time Number 1
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X5 = Signal Off Time Number 1
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

(Continued)

REORDERT[,X1,X2,X3,X4, X5,X6,X7,X8,X9] (Cont.)

REORDERT[,,X2,X3,X4,X5, X6,X7,X8,X9,X10,X11] (Cont.)

X6 = Signal On Time Number 2
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X7 = Signal Off Time Number 2
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X8 = Signal On Time Number 3
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X9 = Signal Off Time Number 3
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X10 = Power of Tone #1 in the REORDER signal
Range: -3.0 to -53.0 dBm
Step: 0.1 dB

X11 = Power of Tone #2 in the REORDER signal
Range: -3.0 to -53.0 dBm
Step: 0.1 dB

Response: OK or ERR code

REORDERT,RST — Description: Restores all argument values to nominal state

REORDERT — Response 5102 will respond with present argument value(s)

REORDER#[,X1] — Description: Set telephone number to access Reorder Tone.

Arguments: X1 = 1 to 20 digit number

Restrictions: *Do not program any two of the programmable central office numbers to the same value.*

The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.

REORDER# — Response: 5102 will respond with present argument value(s)

Description: Resets the 5102 and the 5151. **RESET**

Or

Description: Resets the 5102 only **RESET,5102**

Or

Description: Resets the 5151 only **RESET,5151**

Arguments: As shown

Response: None

Note: *These commands cause actions similar to the "Back Door" manual power up procedure. The 5102 does not provide a response to these instructions. Consequently, it is required to allow a minimum delay of 3 seconds before sending another instruction.*

Description: Set Reverse Channel Attenuation **REVATT[,X1]**

Arguments: X1 = Attenuation Value
Range: 0 to 42 dB
Step: 1 dB

Response: OK or ERR code

Response: 5102 will respond with present argument value(s) **REVATT**

Description: Ring the selected channel the designated number of times. **RING[,X1,X2]**

Arguments: X1 = Channel to ring, A or B
X2 = # of rings, 000 to 255

First Response Following Command: OK or ERR code
Second Response:
(Issued after the event occurs): NO CONNECT
ANSWERED
NO LOOP CURRENT

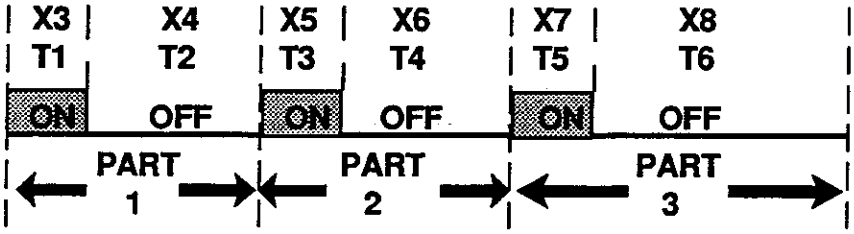
Restriction: *The Off cadence of #3 must be ≥ the sum of other cadences.*

COMMAND	SUMMARY	
RINGBKT[,X1,X2,X3]	Description:	Set composite power and frequencies of the Ringback signal.
RINGBKT[,,X2,X3,X4,X5,]	Description:	Set individual power and frequencies of the Ringback signal.
	Arguments:	X1 = Composite Power of Ringback signal Nominal: See Technical Reference Section Range: 0.0 to -50.0 dBm Step: 0.1 dB
		X2 = Frequency #1 Nominal: See Technical Reference Section Range: 0 to 3000 Hz Step: 1 Hz
		X3 = Frequency #2 Nominal: See Technical Reference Section Range: 0 to 3000 Hz Step: 1 Hz
		X4 = Power of Tone #1 Range: -3.0 to -53.0 dBm Step: 1 dB
		X5 = Power of Tone #2 Range: -3.0 to -53.0 dBm Step: 1 dB
	Note:	*The RINGBK signal follows the cadence format of the RINGING signal and occurs during the T6 part of the RINGING signal.*
	Response:	OK or ERR code
RINGBKT	Response:	5102 will respond with present argument value(s)
RINGBK#[,X1]	Description:	Set telephone number to access the ringback tone.
	Arguments:	X1 = 1 to 20 digit number
	Restrictions:	*Do not program any two of the programmable central office numbers to the same value.* *The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.*
RINGBK#	Response:	5102 will respond with present argument value(s)

Description: Set RMS voltage level, frequencies and cadence of the Ring signal.

RINGINGT[,X1,X2,X3,X4, X5,X6,X7,X8]

The ring signal period is composed of 1, 2 or 3 separately controllable parts. Each part has an ON time and an OFF time. The parameters X3 through X8 specify the time values for the six intervals T1 through T6. The occurrence order of the intervals and the relationship to X3 through X8 are shown below. Note that there are constraints which govern the use of these parts.



The programming of the RING signal varies based upon the number of cadence periods required.

For a single cadence signal only PART 3 is used (i.e., use X7 and X8).

Example: RINGINGT,X1,X2,0,0,0,0,X7,X8

For a dual cadence signal use PART 2 and PART 3.

Example: RINGINGT,X1,X2,0,0,X5,X6,X7,X8

For a triple cadence signal use all arguments.

Example:

RINGINGT,X1,X2,X3,X4,,X5,X6,X7,X8

Restriction *The off time of PART 3 must be equal or greater than the sum of all other parts.*

Example: $T6 \geq T1 + T2 + T3 + T4 + T5$

(Continued)

RINGINGT[,X1,X2,X3,X4, X5,X6,X7,X8] (Cont.)

Arguments:

X1 = RMS voltage of RING signal into Ringer Equivalence of 1.0
Nominal: See Technical Reference Section
Values: 20-90 Vrms
Step: 1 Vrms

X2 = Frequency
Nominal: See Technical Reference Section
Range: 10-60 Hz
Step: 1 Hz

X3 = On Time (T1) for PART 1 of the RING signal
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

Constraints:
$T1 \leq T6-T2-T3-T4-T4$

X4 = Off Time (T2) for PART 1 of the RING signal
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

$T2 \leq T6-T1-T3-T4-T5$

X5 = On Time (T3) for second part of the RING signal
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

$T3 \leq T6-T1-T2-T4-T5$

X6 = Off Time (T4) for second part of the RING signal
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

$T4 \leq T6-T1-T2-T3-T5$

X7 = On Time (T5) for second part of the RING signal
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

$T5 \leq T6-T1-T2-T3-T4$

X8 = Off Time (T6) for PART 3 of the RING signal
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

$T6 \leq T1-T2-T3-T4-T5$

Response: OK or ERR code

RINGINGT,RST Description: Restores all argument values to nominal state

RINGINGT Response: 5102 will respond with present argument value(s)

SUMMARY	COMMAND
Description: Save the current state of the 5102 in selected address.	SAVE[,X1]
Arguments: X1 = Address to SAVE state Range: 0 to 9	
Response: 5102 will respond with present argument value(s)	SAVE

Note: *The SAVE command saves the default values for the CO that is active at the time the SAVE command is executed. To save CO parameters other than the defaults for a given country, the modified CO parameters must be saved in one of the USER CO locations.. The USER CO must then be the active CO when the SAVE command is executed.*

Description: Set power, frequencies, and cadence of the Secondary Dial Tone. **SDIALT[,X1,X2,X3,X4,X5, X6,X7,X8,X9,X10]**

Arguments:

X1 = Signal Power of the Secondary Dial Tone
Nominal: See Technical Reference Section
Range: 0.0 to -50.0 dBm
Step: 0.1 dB

X2 = Frequency #1
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X3 = Frequency #2
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X4 = Frequency #3
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X5 = Signal On Time Number 1
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

(Continued)

SDIALT[,X1,X2,X3,X4,X5, X6,X7,X8,X9,X10] (Cont.)

X6 = Signal Off Time Number 1
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X7 = Signal On Time Number 2
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X8 = Signal Off Time Number 2
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X9 = Signal On Time Number 3
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X10= Signal Off Time Number 3
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

Response: OK or ERR code

SDIALT,RST Description: Restores all argument values to nominal state.

SDIALT Response: 5102 will respond with present argument value(s).

SDIALT#[,X1] Description: Set telephone number to access Secondary Dial Tone

Arguments: X1= 1 to 20 digit number

Restrictions: *Do not program any two of the programmable central office numbers to the same value.*

The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.

SDIALT# Response: 5102 will respond with present argument value(s).

SUMMARY		COMMAND
Description:	Set the Port B output Signal to Noise Ratio (3 KHz Noise)	SNR[,X1]
Arguments:	X1 = Output SNR (dB) Range: OFF or 0.0 to 50.0 dB (OFF turns off source noise) Step: 0.1 dB	
Response:	OK or ERR code	
Response:	5102 will respond with present argument value(s)	SNR
Restriction:	*SNR setting can not require a noise floor < -80 dBm*	

Description:	Set the Port B Signal to Noise Ratio (C-Message Weighted)	SNRCMSG[,X1]
Arguments:	X1 = Output SNR (dB) Range: OFF or 1.6 to 51.6 dB (OFF turns noise source off) Step: 0.1 dB	
Response:	OK or ERR code	
Response:	5102 will respond with present argument value(s)	SNRCMSG
Restriction:	*SNR setting can not require a noise floor < -80 dBm*	

Description:	Set the Port B output Signal to Noise Ratio (Psophometric) Weighted.	SNRPSOP[,X1]
Arguments:	X1 = Output SNR (dB) Range: OFF or 2.2 to 52.2 dB (OFF turns noise source off) Step: 0.1 dB	
Response:	OK or ERR code	
Response:	5102 will respond with present argument value(s)	SNRPSOP
Restriction:	*SNR setting can not require a noise floor < -80 dBm*	

SPECIALT[,X1,X2,X3,X4, X5,X6,X7,X8,X9,X10,X11, X12,X13]

Description: Set power, frequencies, and cadence of the Special tone.

Arguments:

X1 = Power of SPECIAL tone signal.
Nominal: See Technical Reference Section
Range: 0.0 to -50.0 dBm
Step: 0.1 dB

X2 = Frequency #1
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1Hz

X3 = Frequency #2
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X4 = Frequency #3
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X5 = Frequency #4
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X6 = Signal On Time Number 1
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X7 = Signal Off Time Number 1
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X8 = Signal On Time Number 2
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

(Continued)

X9 = Signal Off Time Number 2
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

SPECIALT[,X1,X2,X3,X4, X5,X6,X7,X8,X9,X10,X11, (Cont.) X12,X13]

X10= Signal On Time Number 3
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X11= Signal Off Time Number 3
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X12= Signal On Time Number 3
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X13= Signal Off Time Number 4
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

Response: OK or ERR code

Description: Restores all argument values to nominal state

SPECIALT,RST

Response: 5102 will respond with present argument value(s)

SPECIALT

Description: Set telephone number to access Special Information Tone.

SPECIAL#[,X1]

Arguments: X1 = 1 to 20 digit number

Restrictions: *Do not program any two of the programmable central office numbers to the same value.*

The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.

Response: 5102 will respond with present argument value(s)

SPECIAL#

SPEED#[,X1]

Description: Set telephone number for speed access from PORT A to B or PORT B to A.

Arguments: X1 = 1digit number
(default = 2)

Restriction: *Do not program any two of the programmable central office numbers to the same value.*

The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.

SPEED#

Response: 5102 will respond with present argument value(s)

SPKR[,X1]

Description: Set the 5102 speaker mode.

Arguments: X1 = OFF - Speaker off
FWD - Forward Channel only
BOTH - Forward and Reverse Channels

Response: OK or ERR code

SPKR

Response: 5102 will respond with present argument value(s)

STATUS

Description: Sends current Status of the 5102 to the controller

Arguments: None

Response: Returns xxxxxxxx, yyyyyyyy formatted as:

xxxxxxxx = (7, 6, 5, 4, 3, 2, 1, 0)		yyyyyyyy = (7, 6, 5, 4, 3, 2, 1, 0)
bit 0 = 0	- channel A on hook	bit 0 unused
1	- channel A off hook	bit 1 unused
bit 1 = 0	- channel B on hook	bit 2 unused
1	- channel B off hook	

(Continued)

(Cont.) **STATUS**

xxxxxxxx = (7, 6, 5, 4, 3, 2, 1, 0)	yyyyyyyy = (7, 6, 5, 4, 3, 2, 1, 0)
bit 2 = 0- AGC not locked	bits 4,3 = 00 - SNR flat 01 - SNR C(P)-MSG 11 - NOISE -dBmC(P) 10 - NOISE dBmC(P)
bit 3 = 1 - Power Out mode 0 - Attenuation mode	
bit 4 = 0 - DTMF Dialing Mode 1 - Pulse Dialing Mode	bit 5 = 1 - C- Message option 0 - Psophometric option
bit 5 = 0 - neither port ringing 1 - either port ringing	bit 6 = 1 - 2-Wire PORT A termination = 600 ohm 0 - 2-Wire PORT A termination = 900 ohm
bit 6 = 0 - Warble tone off 1 - Warble tone on	
bit 7 Unused	bit 7 = 1 - 2 - Wire PORT B termination = 600 ohm 0 - 2-Wire PORT B termination = 900 ohm

Description: Select a 5102 line impairment **STD[,X1]**

Arguments: X1 = FLAT, C1, C2, C4, 3002A, 3002B, TR30-1, TR30-2, TR30-3, TR30-4, TR30-5, TR30-6, M1020, M1025, M1040, NTT-1, NTT-2, NTT-3, NTT-4, NTT-5, NTT-6, NTT-7, CONUS-PV, CONUS-MV, CONUS-PD, CONUS-MD, EUROP-PV, EURO-MV, EURO-PD, EURO-MD, DEF

Note: *DEF implements the previous settings for definable lines.*

Response: OK or ERR code or
UNDER, Input signal < -25 dBm
OVER, Input signal > +3 dBm

Response: The 5102 will respond with present argument values **STD**

TCAL	Description:	Used to automatically generate tones on Port A and then Port B. Also sends AGC command to the appropriate 5151. Provides a one-step 1004 Hz calibration.
	Argument:	None
	Note:	*Preset A and Preset B must be correct before issuing this command.*
	Restriction:	*This command can only be used in a bidirectional test mode in conjunction with two PTT 5151s.*
	Response:	OK or ERR

TELNUMA[,X1]	Description:	Set telephone number for network interface PORT A.
	Arguments:	X1 = 1 to 20 digit number
	Restrictions:	*Do not program any two of the programmable central office numbers to the same value.* *The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.*
TELNUMA	Response:	5102 will respond with present argument value(s)

TELNUMB[,X1]	Description:	Set telephone number for network interface PORT B.
	Arguments:	X1 = 1 to 20 digit number
	Restrictions:	*Do not program any two of the programmable central office numbers to the same value.* *The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.*
TELNUMB	Response:	5102 will respond with present argument value(s)

Description: Activates the 1004 Hz calibration tone for Port A or B. **TGEN[,X1]**

Arguments: X = A activate tone on Port A output
= B activate tone on Port B output
= OFF turn tone off

Note: *Preset A and Preset B must be correct before issuing this command.*

Restriction: *This command can only be used in a bidirectional test mode in conjunction with two PTT 5151s.*

Response: OK or ERR

Description: Save the current state of the 5102 Central Office being used (Saves CO parameters only). **USER[,X1]**

Arguments: X1 = Address To SAVE state
Range: 0 to 4

Response: OK or ERR code

Description: Query for the 5102 Software Version **VERSION**

Arguments: None

Response: Returns #.xxyy software where:
# = Software Release Number
X = Control software version
Y = Processing software version

Description: Set the 5102 speaker volume. **VOL[,X1]**

Arguments: X1 = 0 to 10
0 = OFF, 10 = Max Volume

Response: OK or ERR code

Response: 5102 will respond with present argument value(s) **VOL**

WARBLEDLY[,X1]

Description: Set the delay between off hook and warble tone.

Arguments: X1 = Delay in seconds
Nominal: 255 sec (disabled)
Range: 0 to 254 sec
Step: 1 sec

Response: OK or ERR code

WARBLEDY

Response: 5102 will respond with present argument value(s)

WARBLET[,X1,X2,X3,X4, X5,X6]

Description: Set power, frequencies, and cadence of the Warble signal when the composite power is set.

OR
WARBLET[,X2,X3,X4,X5, X6,X7]

Description: Set power, frequencies, and cadence of the Warble signal when the each signal power is set.

Arguments: X1 = Power of WARBLE signal.
Nominal: See Technical Reference Section
Range: 0.0 to -50.0 dBm
Step: 0.1 dB

X2 = Frequency #1
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1Hz

X3 = Frequency #2
Nominal: See Technical Reference Section
Range: 0 to 3000 Hz
Step: 1 Hz

X4 = Signal On Time for WARBLE
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

X5 = Signal Off Time for WARBLE
Nominal: See Technical Reference Section
Range: 0.00 to 9.95 sec
Step: 0.05 sec

(Continued)

X6 = Power of Tone #1 in Warble Signal
Range: -3.0 to -53.0 dBm
Step: 0.1 dB

X7 = Power of Tone #2 in Warble Signal
Range: -3.0 to -53.0 dBm
Step: 0.1 dB

WARBLET[,X1,X2,X3,X4, X5,X6] (Cont.)

OR

WARBLET[,X2,X3,X4,X5, X6,X7] (Cont.)

Response: OK or ERR code

Description: Resets the WARBLE tone parameters to default settings. **WARBLET,RST**

Response: 5102 will respond with present argument value(s) **WARBLET**

Description: Set telephone number to access WARBLE tone. **WARBLE#[,X1]**

Arguments: X1 = 1 to 20 digit number

Restrictions: *Do not program any two of the programmable central office numbers to the same value.*

The first digit of each programmable number must not be the digit assigned to SPEED DIAL or the INTERNATIONAL DIAL TONE.

Response: 5102 will respond with present argument value(s) **WARBLE#**

Description: Turn external hybrid balance on or off for PORT A. **XHYBRIDA[,X1]**

Arguments: X1 = OFF - PORT A balance internal
ON - PORT A balance external

Response: OK or ERR code

Response: 5102 will respond with present argument value(s) **XHYBRIDA**

Description: Turn external hybrid balance on or off for PORT B. **XHYBRIDB[,X1]**

Arguments: X1 = OFF - PORT B balance internal
ON - PORT B balance external

Response: OK or ERR code

Response: 5102 will respond with present argument value(s) **XHYBRIDB**

SECTION 5 - ERROR CODES

COMMAND RESPONSE ERROR MESSAGES

Code	Description	
Err 1	Invalid Argument	Argument was incorrectly entered - possibly a missing comma.
Err 2	Missing Argument	An argument is required after this command.
Err 3	Argument Out of Range	Argument not within range of acceptable values as specified in the command summary.
Err 4	Invalid Command	Command was either typed incorrectly or not supported.
Err 5	Invalid Mode	This response is received when controller attempts to execute a command not acceptable to the current mode of operation; e.g., attempting to execute AGC on dial tone.
Err 6	End of Line Buffer (No Command Found)	Data received from external controller did not contain a valid command before the end of the buffer was reached.
Err 7	PTT 5151 Access Attempted - No Response	A command destined for the PTT 5151 was received, but the 5151 did not respond when accessed.
Err 8	Requested Setting not Achievable	The requested setting is not achievable due to system hardware constraints: e.g., attempting to set the SNR to a value that would result in the additive noise level being less than -80 dBm. The parameter is set to the nearest achievable value and an error response is generated.

SECTION 6 - TECHNICAL REFERENCE

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FRONT AND REAR PANEL CONNECTORS AND INTERFACE DESCRIPTION

Front Panel

The front panel is fitted with four telephone jack connectors for connection of the unit under test and the reference unit. (See Figure, Section 3, page 1.)

Rear Panel

The rear panel is fitted with six telephone jack connectors, one terminal strip, and the IEEE-488 and RS-232C controller interfaces. (See Figure, Section 3, page 4.)

2-Wire Connectors

There are four of the 2-Wire connectors:

Front Panel: inputs for Network Interface A and B
Back Panel: corresponding 2-Wire connections

Connectors on Front Panel: RJ11 AMP 520525-2

Connectors on Rear Panel: RJ11 AMP 520520-2

TABLE 3: 2-WIRE PANEL CONNECTOR

PIN #	FUNCTION	COMMENTS
1	NOT USED	
2	MI	
3	RING (RED)	Input/Output
4	TIP (GREEN)	Input/Output
5	MIC	
6	NOT USED	

The MI and MIC pins are not used on the PORT A interface (always an open connection). Provision is made on the PORT B interface to allow for the internal shorting and opening of the MI and MIC leads.

Pin Arrangement

When viewed from the front of the 5102, the pin arrangement on the RJ11 connector is:

1 2 3 4 5 6

Note: Pins 1 and 6 may be missing from the connector.

4-Wire Connectors

There are four of the 4-Wire connectors:
Front Panel: inputs for Network Interface A and B
Back Panel: corresponding 4-Wire connections

Connectors on Front Panel: RJ45 AMP 5205259-3

Connectors on Rear Panel: RJ45 AMP 5205251-3

TABLE 4: 4-WIRE PANEL CONNECTOR

PIN #	FUNCTION	COMMENTS
1	Not Used	
2	Not Used	
3	RX (BLACK)	Output from 5102
4	TX (RED)	Input to 5102
5	TX (GREEN)	Input to 5102
6	RX (YELLOW)	Output from 5102
7	Not Used	
8	Not Used	

Pin Arrangement

The MI and MIC pins for Ports A and B are not used. They are always in an open condition.

When viewed from the front of the 5102, the pin arrangement on the RJ45 connector is:

1 2 3 4 5 6 7 8

Note: Pins 1 and 8 may be missing from the connector.

External Balance Connectors

There are two type of onnectors available on the rear panel for external balance connection.

The two RJ11 telco jacks are for Port A and Port B balance impedance.

Connector: RJ11 AMP 520525-2

TABLE 5: RJ11 PANEL CONNECTOR

PIN #	FUNCTION	COMMENTS
1	NOT USED	
2	NOT USED	
3	BALANCE A	BALANCE IMPEDANCE
4	GND	BALANCE IMPEDANCE
5	NOT USED	
6	NOT USED	

Note

Any two port network used for balance should be connected with one lead on "BAL A" and the other on "GND".

The terminal strip provides access to the same balance impedance connection points and adds the 4-Wire signal monitoring points.

Connector: WIELAND: 8 PIN TERM. STRIP 25-220-3853.1
8 PIN SOCKET 25-330-0853.1

TABLE 6: WIELAND PANEL CONNECTOR

PIN #	FUNCTION	COMMENTS
1	TxA	Port A Output
2	RxA	Port A Input
3	GND	
4	BAL A	
5	TxB	Port B Output
6	RxB	Port B Input
7	GND	
8	BAL B	

Note

Any two port network used for balance should be connected with one lead on "BAL A" and the other on "GND".

INTERFACE LEVELS

Signal Levels

INPUT -

The simulator requires an input power level between -25 dBm and +3 dBm.

OUTPUT -

The simulator can provide output signal levels that are in the range of -55 dbm up to 0 dbm.

Impedance Levels

2-WIRE MODE OF OPERATION -

The input and output impedances are 600 ohms in parallel with a 0.0022 µF capacitor. 900 ohms is also available through a strap option. These straps are located on the daughter card nearest the front panel of the unit.

Each three position strap is marked with a 6 (600 ohms) and a 9 (900 ohms) to indicate the proper orientation.

There are 14 straps that must be set to program the termination impedance.

4-WIRE MODE OF OPERATION -

The input and output impedance is fixed at 600 ohms resistive.

Note

See Maintenance Section for changing strap options.

Rear Panel RS-232C Remote Control Port

This connector provides for the interface of a dumb terminal or a computer to facilitate remote control of the 5102 system parameters. The data rates and character definitions are described in the Remote Operation Section.

Connector on Rear Panel: RS-232C BERG 68232-025

TABLE 7: REAR RS-232C PANEL CONNECTOR

PIN #	CKT DIRECTION	FUNCTION
2	BA FROM DTE	TD Transmit Dat
3	BB TO DTE	RD Receive Data
5	CB TO DTE	CTS Clear to Send
6	CC *	DSR Data Set Ready
7	AB	Signal Ground
8	CF *	CD Data Carrier Detect
20	CD FROM DTE	DTR Data Terminal Ready

* Pulled high through 3.3K ohms to +12 Volts DC in the 5102.

Rear Panel
IEEE-488
Remote Control Port

This connector provides for the interface of an IEEE-488 bus (GPIB) and permits remote control of the 5102 system parameters. The pin definitions and functionality are specified in ANSI/IEEE Std 488-1978 and IEEE Std 728-1982. Refer to the Remote Operations section for additional details.

Connector on Panel: IEEE-488 *BERG 68519-001*
AMPH 57-92245-12

TELEPHONE NUMBER, CALL DELAY

AND INTERNATIONAL DIAL TONE NOMINALS

TABLE 8: TEL NUMBER NOMINAL VALUES

Primary Dial Tone	555-DIAL	(555-3425)
Secondary Dial Tone	55S-DIAL	(557-3425)
International Dial Tone	8	
Busy Tone	555-BUSY	(555-2879)
Reorder Tone	REO-RDER	(736-7337)
Warble	5WA-RBLE	(592-7253)
Special Info. Tone	555-SPEC	(555-7732)
Ringback Tone	55R-BACK	(557-2225)
PORT A	55P-ORTA	(557-6782)
PORT B	55P-ORTB	(556-6782)
Speed Dial Digit	2	

TABLE 9: CALL DELAY NOMINAL VALUES

ON-OFF Hook Delay	0.7 Seconds
OFF-ON Hook Delay	0.6 Seconds
Connect Delay	0.1 Seconds
Dial Delay	0.1 Seconds
Call Delay	0.1 Seconds
Warble Delay	OFF

TABLE 10: INTERNATIONAL DIAL TONE NOMINAL VALUES

Power of Each Tone	-12 dBm
Frequency of Tone 1	900 Hz
Frequency of Tone 2	1020 Hz
Frequency of Tone 3	1140 Hz
On Time for Each Tone	0.4 Seconds
Call Delay	0.1 Seconds

CENTRAL OFFICE NOMINAL VALUES

The tables contained in the following pages relate to the parameter setting for each call progress tone for each country simulated by the 5102. The reference document used to compile this information is CCITT **recommendation E. 180.** Information for each tone of every country is not available from this document. In these cases PTT has substituted values available from other sources.

NOTES:

RINGBACK	RINGBACK is sometimes called the RINGING TONE and should not be confused with the RING signal.
REORDER	REORDER is sometimes called the CONGESTION TONE.
CADENCE 1	The terminology used for CADENCE 1 implies the first ON/OFF interval and CADENCE 2 implies the second ON/OFF interval of a periodic sequence composed of the composite CADENCE 1 and CADENCE 2. Refer to Appendix A for programming commands that control the cadence intervals.
WARBLE	WARBLE tone is sometimes referred to as HOWLER tone.

Table 11: Australia Payphone CO Nominal Values

AUSTRALIA	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 16 dBm	- 16 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	425 Hz	900 Hz	383 Hz	425 Hz	400 Hz	1400 Hz	950 Hz	17 Hz
Frequency 2	0 Hz	1020 Hz	417 Hz	0 Hz	0 Hz	2040 Hz	1400 Hz	0 Hz
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	0.0	0.4	0.4	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	0.35	0.4	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	0.4	NA	NA	NA	0.35	0.4
Cadence 2 OFF (Sec.)	0.0	0.0	0.2	NA	NA	NA	0.0	0.2
Cadence 3 ON (Sec.)	0.0	0.4	0.4	NA	NA	NA	0.3	0.4
Cadence 3 OFF (Sec.)	0.0	0.0	2.0	NA	NA	NA	1.0	2.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Note: This CO will reverse the polarity of Tip and Ring of the calling port when the receiving port goes off hook.

Table 12: Belgium CO Nominal Values

BELGIUM	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 dBm
Frequency 1	450 Hz	900 Hz	450 Hz	450 Hz	450 Hz	1400 Hz	900 Hz	20 Hz
Frequency 2	0 Hz	1020 Hz	0 Hz	0 Hz	0 Hz	2040 Hz	1380 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1860 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.35	0.0	.15	0.5	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	.15	0.5	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.35	0.0	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	0.0	NA	0.0	NA -	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.3	0.3	NA	0.0	NA	0.3	0.0
Cadence 3 OFF (Sec.)	0.0	0.0	0.0	NA	0.0	NA	1.0	3.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 13: Canada CO Nominal Values

CANADA	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	45 Vrms
Frequency 1	350 Hz	900 Hz	440 Hz	480 Hz	480 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	440 Hz	1020 Hz	480 Hz	620 Hz	620 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	0.0	0.5	0.25	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	0.5	0.25	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	0.0	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	NA	NA	0.0	NA	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.4	NA	NA	0.0	NA	0.3	2.0
Cadence 3 OFF (Sec.)	0.0	0.0	NA	NA	0.0	NA	1.00	4.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 14: France CO Nominal Values

FRANCE	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	45 Vrms
Frequency 1	440 Hz	900 Hz	400 Hz	440 Hz	440 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	0 Hz	1020 Hz	0 Hz	0 Hz	0 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	0.0	0.5	0.5	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	NA	0.5	0.5	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	0.0	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	0.0	NA	0.0	NA	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.4	1.7	NA	0.0	NA	0.3	1.65
Cadence 3 OFF (Sec.)	0.0	0.0	3.3	NA	0.0	NA	1.0	3.35
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 15: Germany CO Nominal Values

GERMANY	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	425 Hz	900 Hz	425 Hz	425 Hz	425 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	0 Hz	1020 Hz	0 Hz	0 Hz	0 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	0.0	0.5	0.25	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	0.5	0.25	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	0.0	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	0.0	NA	0.0	NA	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.4	1.0	NA	0.0	NA	0.3	1.0
Cadence 3 OFF (Sec.)	0.0	0.0	4.0	NA	0.0	NA	1.0	4.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 16: Ireland CO Nominal Values

IRELAND	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	50 Hz	900 Hz	375 Hz	400 Hz	400 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	0 Hz	1020 Hz	475 Hz	0 Hz	0 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	0.0	0.4	0.4	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	0.35	0.35	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	0.4	NA	0.0	NA	0.35	0.4
Cadence 2 OFF (Sec.)	0.0	0.0	0.2	NA	0.0	NA	0.0	0.2
Cadence 3 ON (Sec.)	0.0	0.4	0.4	NA	0.0	NA	0.3	0.4
Cadence 3 OFF (Sec.)	0.0	0.0	2.0	NA	0.0	NA	1.0	2.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 17: Japan CO Nominal Values

JAPAN	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-20 dBm	-20 dBm	- 5 dBm	- 5 dBm	- 5 dBm	- 5 dBm	-5 dBm	70 Vrms
Frequency 1	400 Hz	400 Hz	384 Hz	400 Hz	400 Hz	400 Hz	950 Hz	16 Hz
Frequency 2	0 Hz	0 Hz	416 Hz	0 Hz	0 Hz	0 Hz	1400 Hz	NA
Frequency 3	NA	0 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.15	0.0	0.5	0.5	1.0	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.1	0.0	0.5	0.5	0.0	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.0	0.0	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	0.0	NA	0.0	NA	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.0	1.0	NA	0.0	NA	0.3	1.0
Cadence 3 OFF (Sec.)	0.0	0.0	2.0	NA	0.0	NA	1.0	2.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Note: This CO will reverse the polarity of Tip and Ring under the following conditions:
1) While ringing signal is present on the receiving port, the receiving port polarity is reversed.
2) When the receiving port goes off hook, the calling port reverses polarity.

Table 18: Korea CO Nominal Values

KOREA	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	350 Hz	900 Hz	440 Hz	480 Hz	480 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	440 Hz	1020 Hz	480 Hz	620 Hz	620 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	0.0	0.5	0.3	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	0.5	0.2	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	0.0	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	0.0	NA	0.0	NA	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.4	1.0	NA	0.0	NA	0.3	1.0
Cadence 3 OFF (Sec.)	0.0	0.0	2.0	NA	0.0	NA	1.0	2.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 19: Netherlands CO Nominal Values

NETHERLANDS	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	150 Hz	425 Hz	425 Hz	425 Hz	425 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	450 Hz	0 Hz	0 Hz	0 Hz	0 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	0 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	1.0	0.0	0.5	0.25	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	0.5	0.25	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.0	0.0	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	0.0	NA	0.0	NA	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.0	1.0	NA	0.0	NA	0.3	1.0
Cadence 3 OFF (Sec.)	0.0	0.0	4.0	NA	0.0	NA	1.0	4.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 20: Norway CO Nominal Values

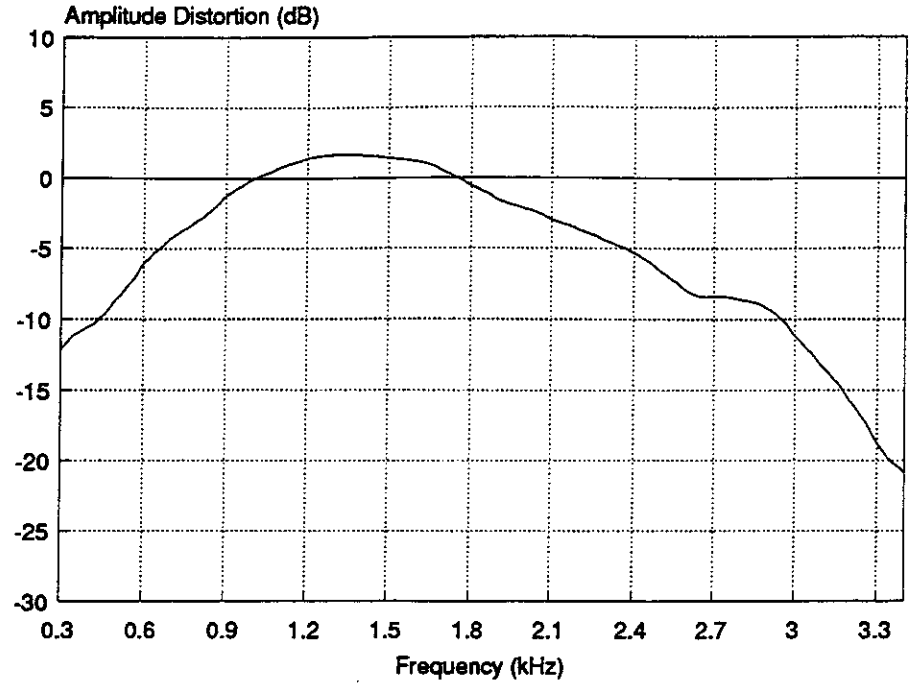
NORWAY	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	425 Hz	900 Hz	425 Hz	425 Hz	425 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	0 Hz	1020 Hz	0 Hz	0 Hz	0 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	0.0	0.5	0.25	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	0.5	0.25	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	0.0	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	0.0	NA	0.0	NA	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.4	1.0	NA	0.0	NA	0.3	1.0
Cadence 3 OFF (Sec.)	0.0	0.0	4.0	NA	0.0	NA	1.0	4.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.

** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.

*** Tones with all of cadence periods set to 0 are ON constantly.

Figure 2: 3002 - MODEL B



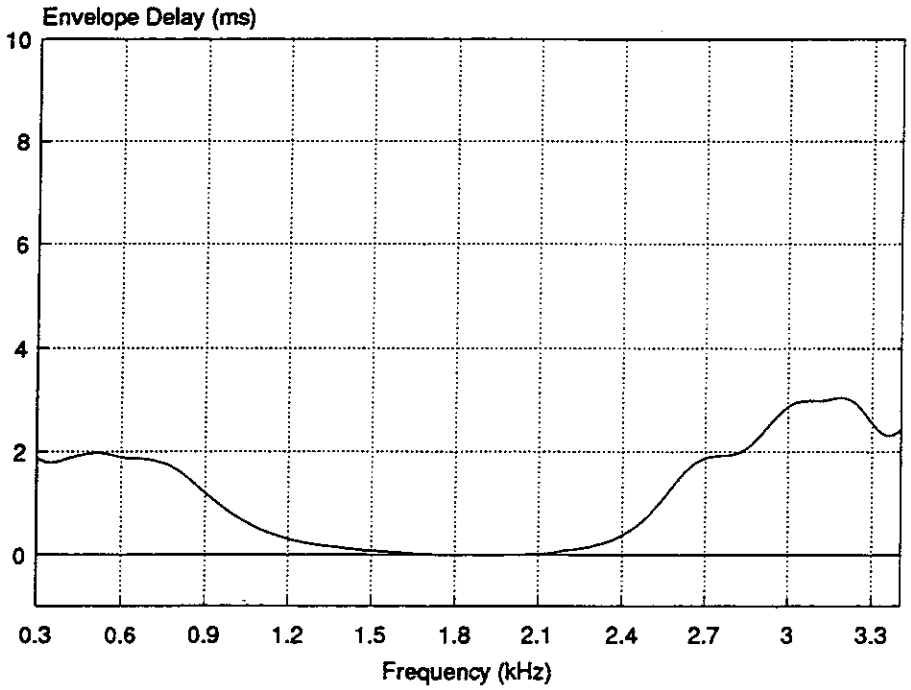
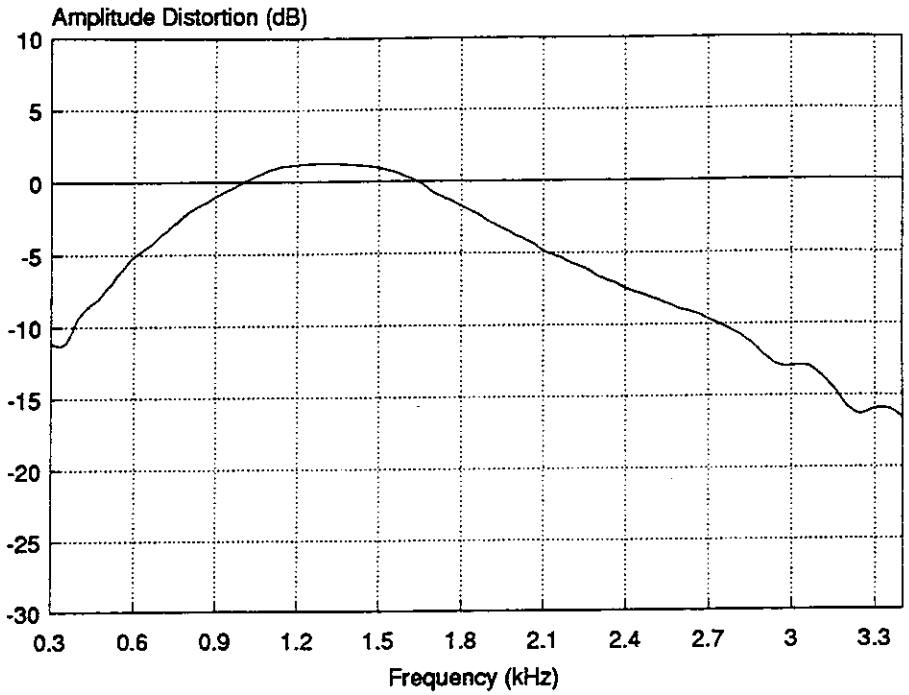
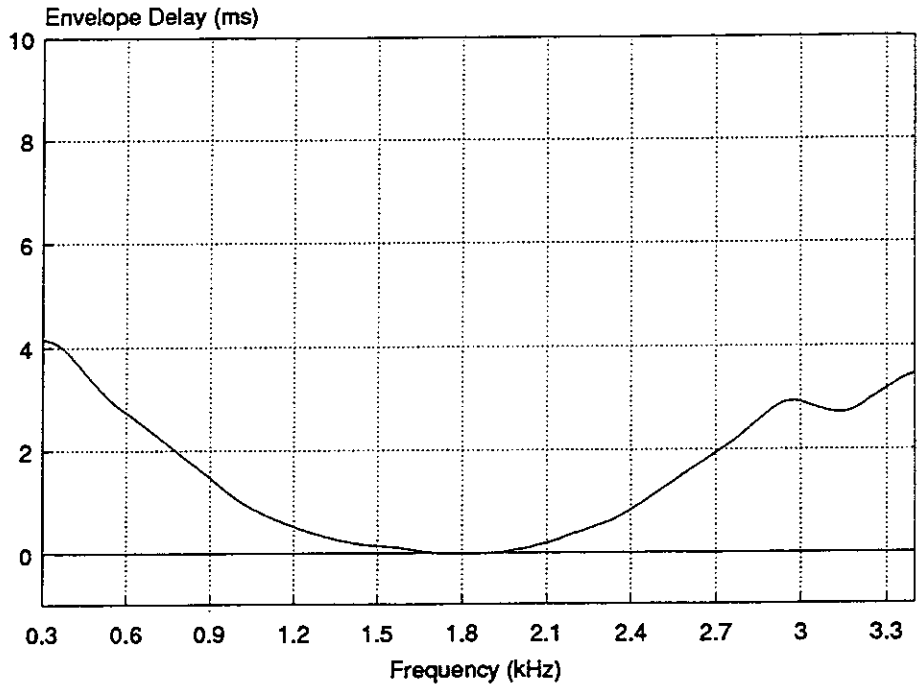


Figure 1: 3002 - MODEL A





AMPLITUDE AND GROUP DELAY PLOTS

On the following pages are graphic illustrations depicting the Amplitude Distortion and Envelope Delay for 30 different preset, and one user defined, line types; which are selected with the Line Type button. The amplitude and delay is set in the Central Office Button submenu, CO Select, Modify CO.

Line Model Plots Amplitude Distortion plots are referenced to 1004 Hz.
Envelope Delay plots are referenced to 1800 Hz.

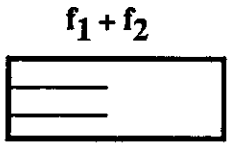
Note: *Definable plots for amplitude and envelope delay distortion are referenced to 1800 Hz.*

NOISE Level Adjust	0 dB to 50 dB SNR in 0.1 dB steps, plus a noise disable. (Constraint: Maximum SNR will be bounded by an absolute minimum noise power of -80 dBm.) The accuracy of the settings is +/- 0.5 dB **Noise Generator Characteristics:** Additive, white pseudo-random noise (sequence length of greater than 5 hours) filtered by a second order Butterworth filter with a 3 dB cutoff of 5000 Hz.
ECHO Level Adjust	3 dB to 40 dB in 1.0 steps, plus an echo disable. The accuracy of the setting is +/- 0.5 dB
Power Measure	Input power on Network Interface A or B Range: -25 dBm to +3 dBm The accuracy of the measurement is +/-0.25 dB Output power on Network Interface B Range: 0 dBm to -55 dBm The accuracy of the measurement is +/-0.25 dBm, 0 to -25 dBm +/-0.5 dBm, -25 to -55 dBm.
Note:	*Power Measurements are referenced to 600 ohms.*
Control Port Interfaces	IEEE-488 (GPIB) Interface Connector:24 Pin Female RS-232C Serial Port Connector: 25 Pin Female "D" Subminiature
Configuration Storage	Ten general-purpose line simulator configurations, and five user defined central office configurations stored in non-volatile memory.

Warble Signal

A warble (howler) tone is sent to the originating station if it remains off hook for longer than the period defined for presenting warble tone. This delay is programmable form the front panel under the CENTRAL OFFICE SELECT button menu or form the remote ports. The nominal specifications are shown in the Technical Reference Section. The warble tone is comprised of two single frequencies and a single cadence period. The default number for accessing Warble tone is 592-7253 (5WA-RBLE).

Cadence Format



Cadence 1

Programmable Signals

The call progress signals can be programmed via the CENTRAL OFFICE SELECT button or through the RS-232C or IEEE-488 control ports (see Manual Operation or Remote Operation):

Frequency:	1 Hz steps from 0 to 3000 Hz.
Amplitude:	0.1 dB steps from -50.0 to 0.0 dBm.
On/Off Cadence:	0.00 to 9.95 sec in 0.05 sec steps.

The ring signal can be programmed via the CENTRAL OFFICE SELECT button or through the RS-232C or IEEE-488 control ports (see Manual Operation or Remote Operation:

Frequency:	1 Hz steps from 10 to 60 Hz.
Amplitude;	20 to 90 Vrms in 1 Vrms steps.
On/Off Cadence:	0.00 to 9.95 sec in 0.05 sec steps.

Attenuation/Output Power Control

Network B Interface: Attenuation/Output Power Adjustment

ATTN (1004 HZ):	-9.9 dB to 55 dB in 0.1 dB steps (Constraint: Output power cannot be less than -55 dBm, or greater than 0 dBm).
OUTPUT POWER:	0 dB to -55 dBm in 0.1 steps (Constraint: Attenuation cannot be greater than 55 dB or less than -9.9 dB). The accuracy of the settings is +/- 0.5 dB

Network A Interface: Attenuation Adjustment

An adjustable attenuation from 0 dB to 42 dB in 1 dB steps relative to the input on Network B Interface.

The setting accuracy is +/- 0.5 dB.

Cadence 3 Off ≥ Cadence 1 ON + Cadence 2 ON + Cadence 3 ON + Cadence 1 OFF + Cadence 2 OFF

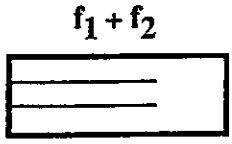
Ringback Signal

A ringback signal is provided to the calling station during the Cadence 3 Off Period of the Ring signal. The Ringback signal nominal specifications are shown in the Technical Reference Section. This signal is comprised of a dual tone with the cadence periods defined by the RING signal (see above). The default number for accessing ringback is 557-2225 (55R-BACK).

Busy Signal

A busy signal is sent to the originating port if the called port is off hook, or by dialing the programmable number for busy tone generation. The default value for this number is 555-2879 (555-BUSY). The Busy signal nominal specifications are shown in the Technical Reference Section. The busy signal is composed of a dual frequency signal governed by a single cadence period.

Cadence Format

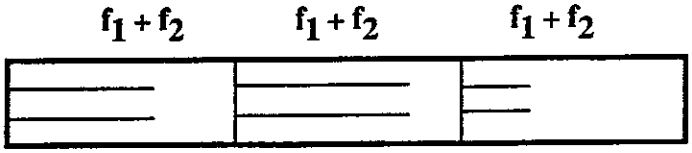


Cadence 1

Reorder Signal

A reorder (congestion) tone is sent to the originating station when the dialed number matches the programmable reorder number. The default value is 736-7337 (REO-RDER). The Reorder signal nominal specifications are shown in the Technical Reference Section. This signal is made up of two single tones controlled by three cadence periods.

Cadence Format

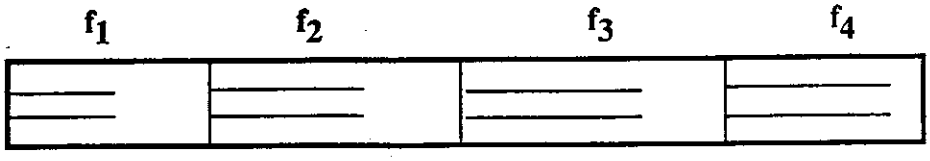


Cadence 1 Cadence 2 Cadence 3

Special Information Tone

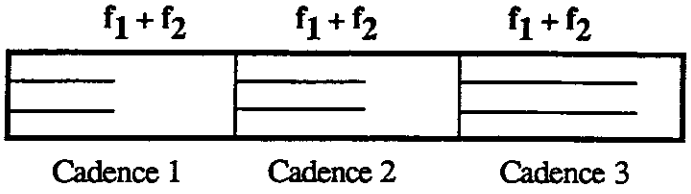
A special information tone is sent to the originating station if the number dialed matches the programmed special information tone number. The nominal specifications are shown in the Technical Reference Section. The special information tone is comprised of four single frequencies and four cadence periods. The default number for accessing the special information tone is 555-7732 (555-SPEC).

Cadence Format



Cadence 1 Cadence 2 Cadence 3 Cadence 4

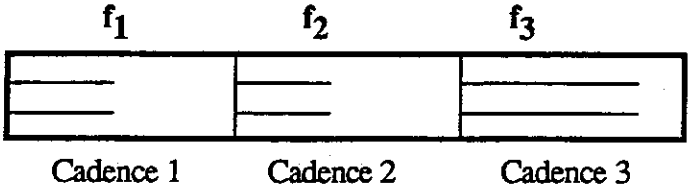
Cadence Format



Secondary Dial Tone

Nominal values depend on central office selection, see the Technical Reference Section. The Secondary Dial Tone signal is composed of three single frequency tones and three cadence periods. The single tones are sequenced, based on the programmed cadence rates. The default number for accessing Secondary Dial Tone is 557-3425 (55S-DIAL).

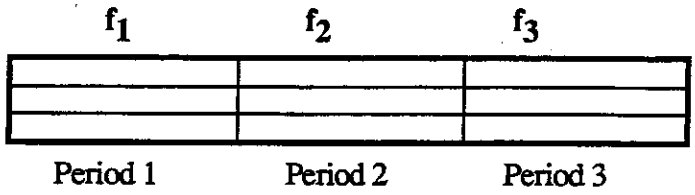
Cadence Format



International Dial Tone

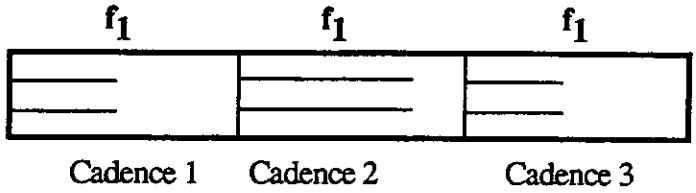
Nominal values depend on central office selection and are shown in the Technical Reference Section. The International Dial Tone signal is composed of three single frequency tones and three programmable duration periods. The single tones are sequenced, based on the programmed cadence rates. The default number for accessing International Dial Tone is 8.

Cadence Format



Ring Signal

Nominal values are shown in the Technical Reference. The voltage levels are specified into a Ringer Equivalence of 1.0. The ring signal is generated by dialing a number that is assigned to either TELCO PORT, or by forcing ring signals from the front panel CENTRAL OFFICE OPERATIONS button. The Ring signal is comprised of a single frequency that may be programmed to RMS voltage levels of 20 to 90 volts governed by three programmable cadence periods.



Note: *The restriction for setting the cadence period requires that the off time for the last programmed cadence period be longer than the sum of all the other on and off times added together.*

Loop Current Disconnect: When a valid connection has been established between ports A and B, and only one of the ports hangs up, then the loop current is momentarily disconnected (600 ms nominal) to the port which remains off hook.

Off Hook Detect: A device must be off hook for the programmed period (on hook to off hook delay period) before an off hook condition is declared. The LED will indicate when each Network Interface station is off hook and more than 10 mA is flowing. The first station that goes off hook is provided a dial tone. When the called station answers and the connect delay is satisfied, the Originate and Answer stations are connected.

Dialing Detection Responds to either DTMF or pulse dialing from either station.

DTMF Input Specifications:

Frequency Values:	+/- 1.5% typical
Minimum Input Level:	-26 dBm composite
Maximum Twist:	10 dB
Minimum Tone Duration:	40 ms
Minimum Interdigit Pause:	40 ms

Pulse Dialing Input Specifications:

Rate	Break
~10pps	50-80 ms
~20pps	30-40 ms

Notes:

PORT A and PORT B may be accessed by dialing the telephone number assigned to the port. The default values are 557-6782 (55P-ORTA, 55P-ORTB). The assigned numbers may be programmed by accessing the CENTRAL OFFICE SELECT button or from the remote port. The number assigned may be up to 20 digits long.

Speed Dialing allows either port to establish a connection to the other port by dialing the programmable speed dial digit, default is 2.

Dialing one of the programmable numbers to access primary dial tone, secondary dial tone, or International dial tone will establish the specified dial tone and dialing may then proceed to access a new tone or one of the TELCO ports.

Primary Dial Tone Nominal values depend on central office election, see the Technical Reference Section. The Primary Dial Tone signal is composed of two single frequency tones and three cadence periods. Dial tone is typically "ON" constantly, which is denoted by setting the OFF period for each cadence to 0.0. The default number for accessing Primary Dial Tone is 555-3425 (555-DIAL).

NTT - Nippon Telephone and Telegraph models for the Japanese telephone network.

Note: *Refer to the Technical Reference Section, Amplitude and Group Delay Plots for plots of the amplitude and envelope delay distortions. Other standard lines may be customized for specific units, upon request.*

Definable Line Types Simulated

The unique DEFINABLE line capability permits programming of the amplitude and delay distortion curves from 10,000 possible combinations. The selection process fixes a frequency point at 1800 Hz which allows the delay and amplitude response to be set at 600 Hz and 3000 Hz relative to the fixed frequency point at 1800 Hz. The selectable values are at 600 Hz (for the low band) and 3000 Hz (for the high band) with respect to the values at 1800 Hz.

Low Band Amplitude:
-25 dB to +10 dB in the following 10 settings:
-25, -20, -15, -10, -6, -3, 0, 3, 6, 10

Low Band Envelope Delay Distortion:
0 to 5.0 ms in the following 10 settings:
0.0, 0.25, 0.5, 0.75, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0

High Band Amplitude:
-25 dB to +10 dB in the following 10 settings:
-25, -20, -15, -10, -6, -3, 0, 3, 6, 10

High Band Envelope Delay Distortion:
0 to 5.0 ms in the following 10 settings:
0.0, 0.25, 0.5, 0.75, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0

Refer to the Technical Reference Section, Amplitude and Group Delay Plots for plots of the amplitude and envelope delay distortions.

Dial Features

Dialing features can be enabled in the 2-Wire mode of operation. Nominal values (shown below) can be changed by control port instructions, (see Remote Control) or, by use of the CENTRAL OFFICE button. Note that loop current must be set to a non-zero value to enable off hook detection.

Line Voltage: Nominally 44 Volts DC +/- 2.5V

Loop Current: Independently set on each port to 0, or 10 to 120 mA in 1 mA steps with an accuracy of +/- (5% + 2 mA).

Note: *Central Office Battery operates as a current source. Therefore current is programmable and voltage will vary depending on the load.*

SPECIFICATIONS

Physical	**Dimension:**	6" x 14 1/2" x 14 1/2"
	Weight:	16 lbs.
Environmental	**Operating Temperature:**	0 to 40 degrees C
	Storage Temperature:	-40 to 85 degrees C
	Humidity:	10% to 90% non-condensing
Power	**Switch Selectable:**	100, 120, 220, 240 Vac (+ 10%), 50/60 HZ
	Fuse:	1.6A, 250V
Simulated Telephone Line Interfaces	**2-Wire Lines:**	Two RJ11 connectors on the front panel and two on the rear panel.
	Input/Output Imprfsnvr:	600 Ohms or 900 ohms in parallel with 0.0022 µF.
	4-Wire Lines:	Two RJ45 connectors on the front panel and two on the rear panel.
	Input/Output Impedance:	600 Ohms Resistive.
	Input Signal Levels:	-25 dBm to +3 dBm.
	Output Levels:	Programmable attenuation at 1004 Hz with respect to the input (-9.9 to 55 dB in 0.1 dB steps), or programmable output power in 0.1 dBm steps from 9.9 dBm larger than the input signal at PORT A to -55 dBm.

Standard Line Types Simulated

3002 WCL	-	3002A and 3002 B lines
Conditioned	-	C1, C2, and C4 Lines.
FLAT	-	A line with linear phase and flat amplitude response.
TR30.3	-	Standard Test Lines. The six lines specified by EIA committee TR30.3 in the 496-A standard.
USA DOD	-	United States Department of Defense models for continental USA data and voice and European data and voice.
CCITT	-	Consultive Committee for International Telephone and Telegraph models.

Table 26: US (United States) CO Nominal Values

US UNITED STATES	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	350 Hz	900 Hz	440 Hz	480 Hz	480 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	440 Hz	1020 Hz	480 Hz	620 Hz	620 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	0.0	0.5	0.25	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	0.5	0.25	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	0.0	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	0.0	NA	0.0	NA	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.4	2.0	NA	0.0	NA	0.3	2.0
Cadence 3 OFF (Sec.)	0.0	0.0	4.0	NA	0.0	NA	9.95	4.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	9.95	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 25: UK (United Kingdom) CO Nominal Values

U.K. (United Kingdom)	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	350 Hz	900 Hz	440 Hz	400 Hz	400 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	440 Hz	1020 Hz	450 Hz	0 Hz	0 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	0.0	0.4	0.4	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	0.35	0.4	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	0.4	NA	0.2	NA	0.35	0.4
Cadence 2 OFF (Sec.)	0.0	0.0	0.2	NA	0.6	NA	0.0	0.2
Cadence 3 ON (Sec.)	0.0	0.4	0.4	NA	0.0	NA	0.3	0.4
Cadence 3 OFF (Sec.)	0.0	0.0	2.0	NA	0.0	NA	1.0	2.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 24: Taiwan CO Nominal Values

TAIWAN	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	90 Vrms
Frequency 1	350 Hz	900 Hz	440 Hz	480 Hz	480 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	440 Hz	1020 Hz	480 Hz	620 Hz	620 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	0.0	0.5	0.3	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	0.0	0.5	0.3	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	0.0	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	0.0	NA	0.0	NA	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.4	1.0	NA	0.0	NA	0.3	1.0
Cadence 3 OFF (Sec.)	0.0	0.0	2.0	NA	0.0	NA	1.0	2.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 23: Switzerland CO Nominal Values

SWITZERLAND	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	425 Hz	900 Hz	425 Hz	425 Hz	425 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	0 Hz	1020 Hz	0 Hz	0 Hz	0 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	NA	0.5	0.5	0.1	0.25	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	NA	0.5	0.5	0.1	0.1	0.0
Cadence 2 ON (Sec.)	0.0	0.4	NA	NA	0.0	NA	0.25	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	NA	NA	0.0	NA	0.15	0.0
Cadence 3 ON (Sec.)	0.0	0.4	NA	NA	0.0	NA	0.25	1.0
Cadence 3 OFF (Sec.)	0.0	0.0	NA	NA	0.0	NA	1.0	4.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 22: Sweden CO Nominal Values

SWEDEN	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	425 Hz	900 Hz	425 Hz	425 Hz	425 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	0 Hz	1020 Hz	0 Hz	0 Hz	0 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	NA	0.25	0.25	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	NA	0.25	0.75	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	NA	NA	0.0	NA	0.35	0.0
Cadence 2 OFF (Sec.)	0.0	0.0	NA	NA	0.0	NA	0.0	0.0
Cadence 3 ON (Sec.)	0.0	0.4	NA	NA	0.0	NA	0.3	1.0
Cadence 3 OFF (Sec.)	0.0	0.0	NA	NA	0.0	NA	1.0	5.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

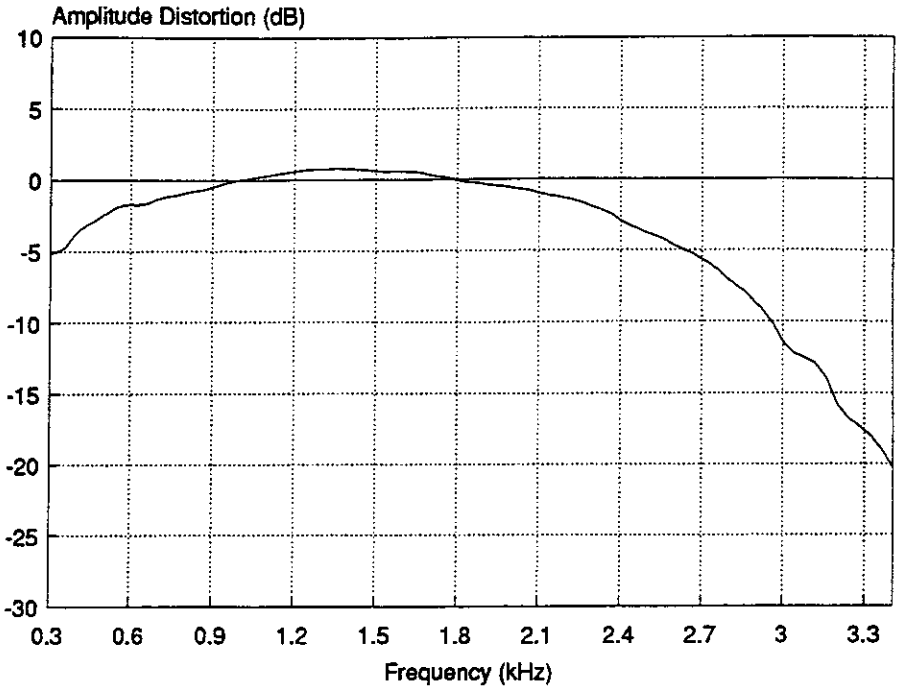
* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Table 21: Singapore CO Nominal Values

SINGAPORE	Primary Dial Tone	Secondary Dial Tone *	Ringback Tone	Busy Tone	Reorder Tone	Warble Tone	Special Info Tone **	Ring Signal
Composite Amplitude	-12 dBm	-12 dBm	- 20 dBm	- 20 dBm	- 20 dBm	- 12 dBm	-12 dBm	60 Vrms
Frequency 1	376 Hz	900 Hz	376 Hz	400 Hz	400 Hz	1400 Hz	950 Hz	20 Hz
Frequency 2	424 Hz	1020 Hz	424 Hz	0 Hz	0 Hz	2040 Hz	1400 Hz	NA
Frequency 3	NA	1140 Hz	NA	NA	NA	NA	1800 Hz	NA
Frequency 4	NA	NA	NA	NA	NA	NA	0 Hz	NA
Cadence 1 ON (Sec.)	1.0	0.4	NA	0.75	0..25	0.1	0.35	0.0
Cadence 1 OFF (Sec.)	0.0 ***	0.0	NA	0.75	0..25	0.1	0.0	0.0
Cadence 2 ON (Sec.)	0.0	0.4	NA	NA	0.0	NA	0.35	0.4
Cadence 2 OFF (Sec.)	0.0	0.0	NA	NA	0.0	NA	0.0	0.2
Cadence 3 ON (Sec.)	0.0	0.4	NA	NA	0.0	NA	0.3	0.4
Cadence 3 OFF (Sec.)	0.0	0.0	NA	NA	0.0	NA	1.0	2.0
Cadence 4 ON (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA
Cadence 4 OFF (Sec.)	NA	NA	NA	NA	NA	NA	0.0	NA

* Frequencies 1, 2 and 3 are single tones sequence ON and OFF at the programmed cadence rate.
** Frequencies 1, 2, 3 and 4 are single tones sequenced ON and OFF at the programmed cadence rate.
*** Tones with all of cadence periods set to 0 are ON constantly.

Figure 3: C-1


Amplitude Distortion (dB)
10
5
0
-5
-10
-15
-20
-25
-30
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3
3.3
Frequency (kHz)

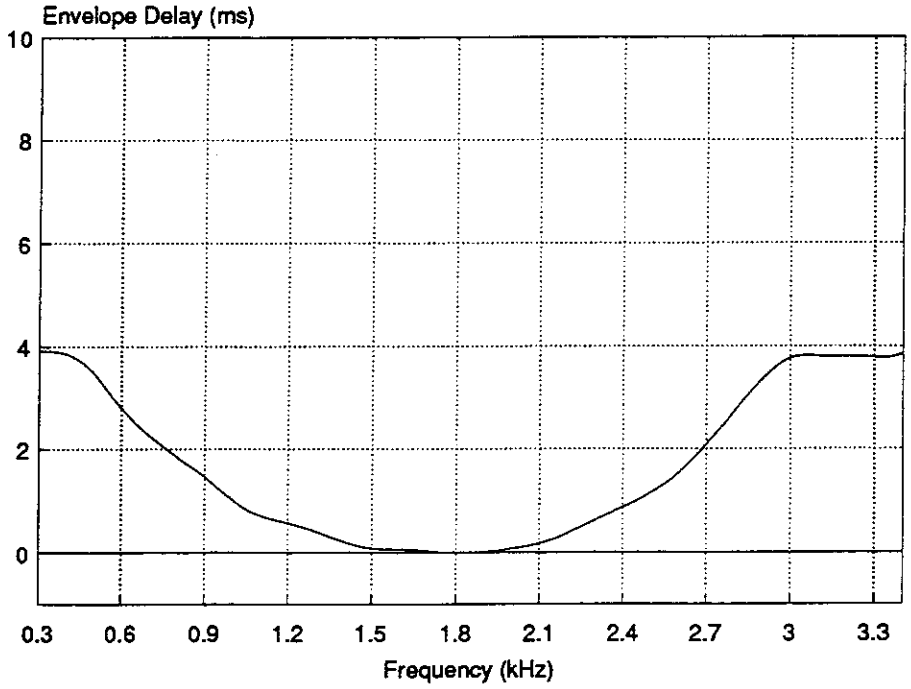
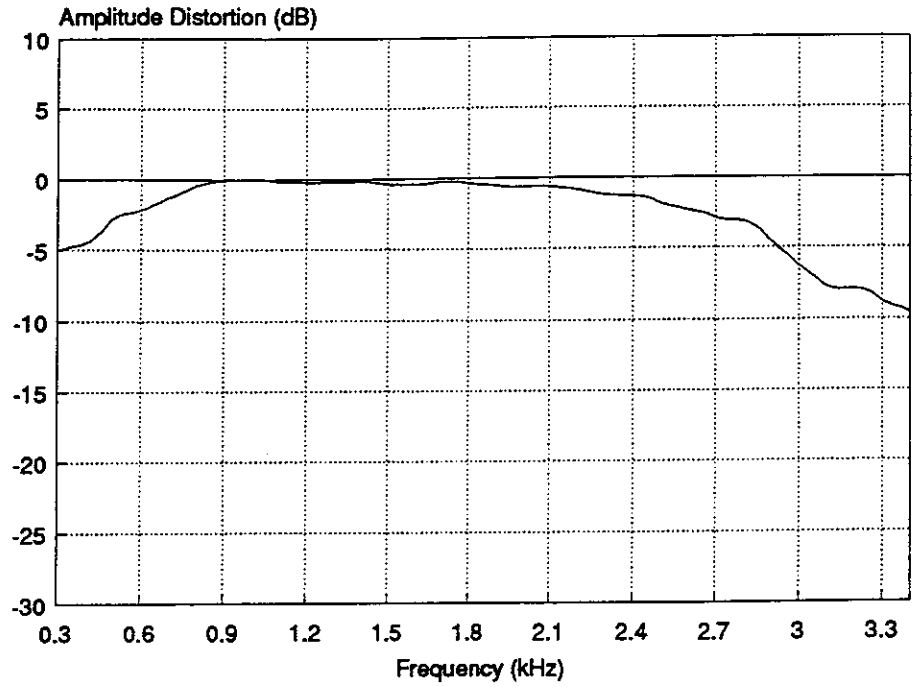

Envelope Delay (ms)
10
8
6
4
2
0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3
3.3
Frequency (kHz)

Figure 4: C-2


Amplitude Distortion (dB)
10
5
0
-5
-10
-15
-20
-25
-30
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3
3.3
Frequency (kHz)

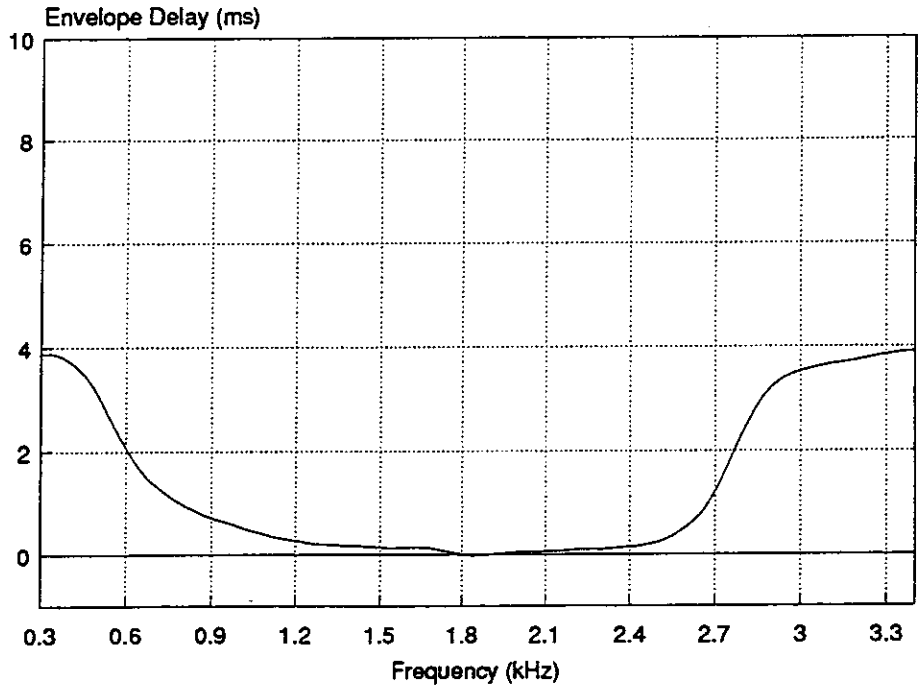
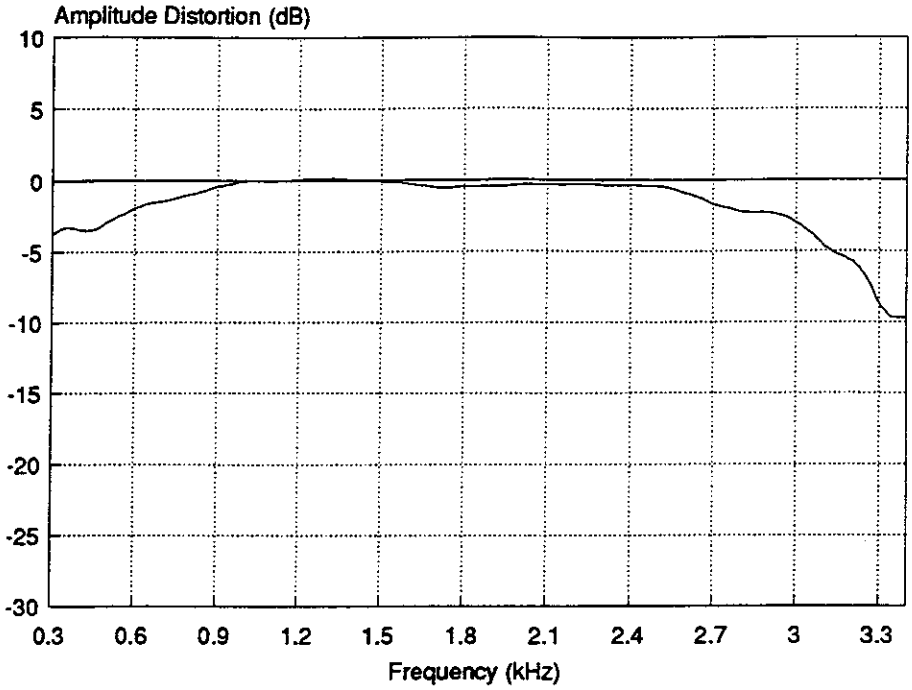

Envelope Delay (ms)
10
8
6
4
2
0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3
3.3
Frequency (kHz)

Figure 5: C - 4


Amplitude Distortion (dB)
10
5
0
-5
-10
-15
-20
-25
-30
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3
3.3
Frequency (kHz)

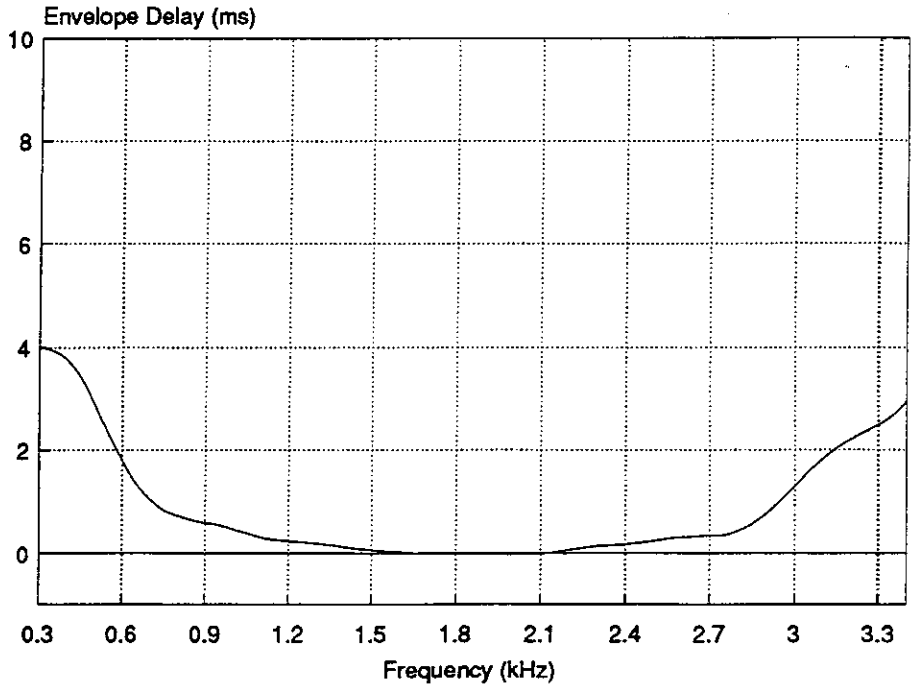
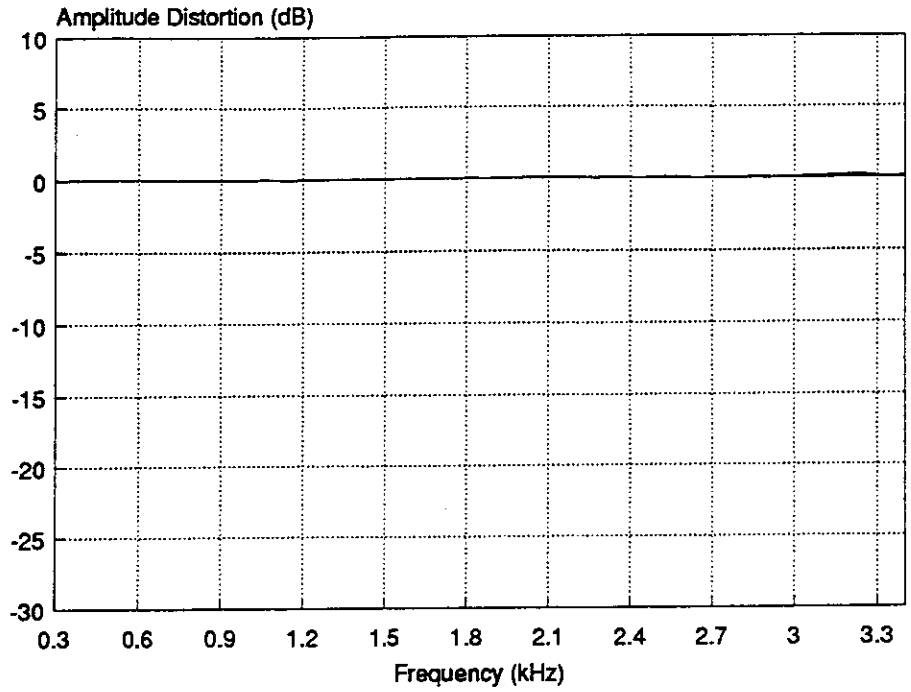

Envelope Delay (ms)
10
8
6
4
2
0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3
3.3
Frequency (kHz)

Figure 6: FLAT



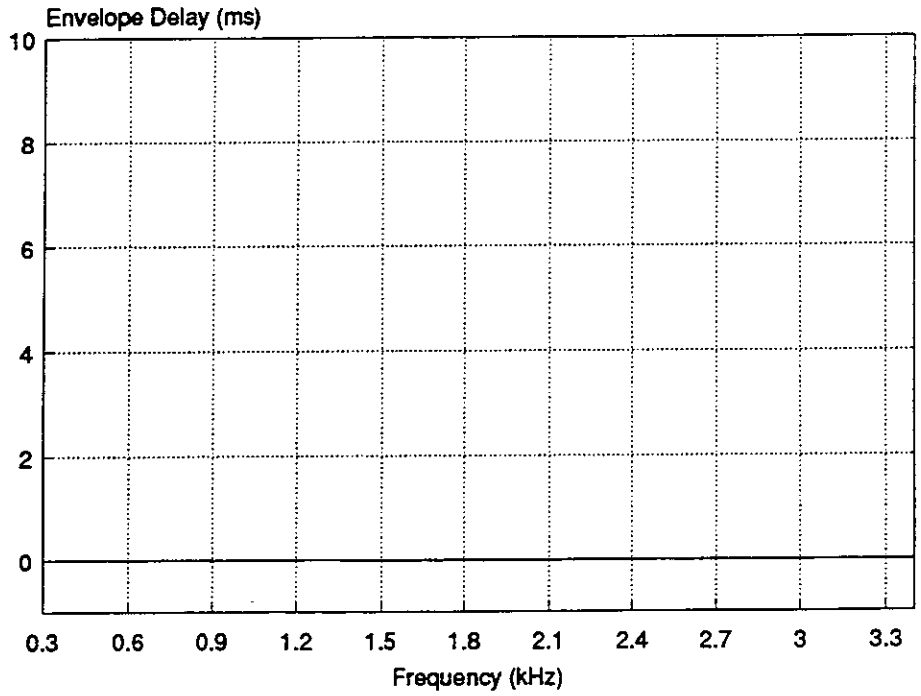
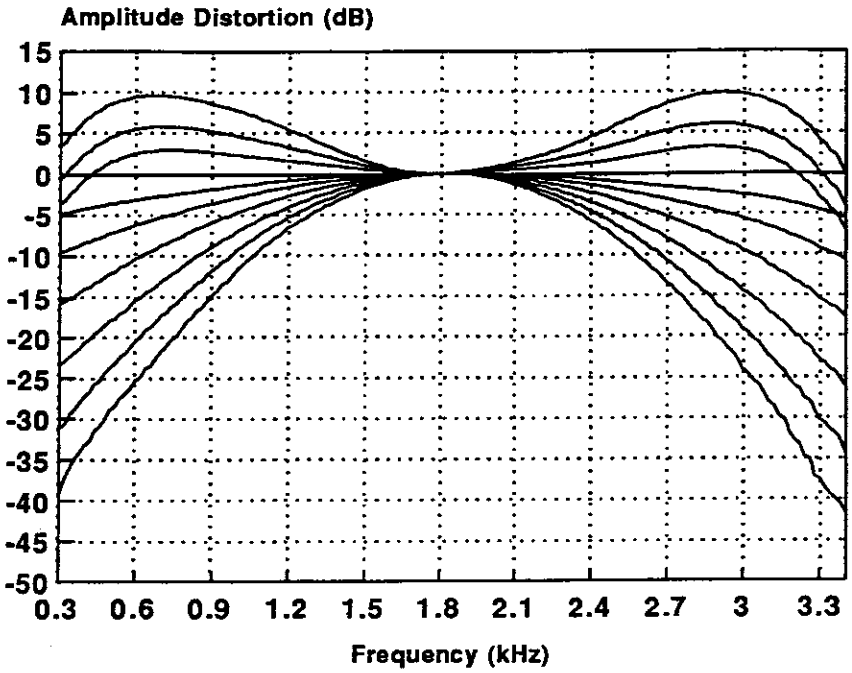


Figure 7: DEFINABLE LINES



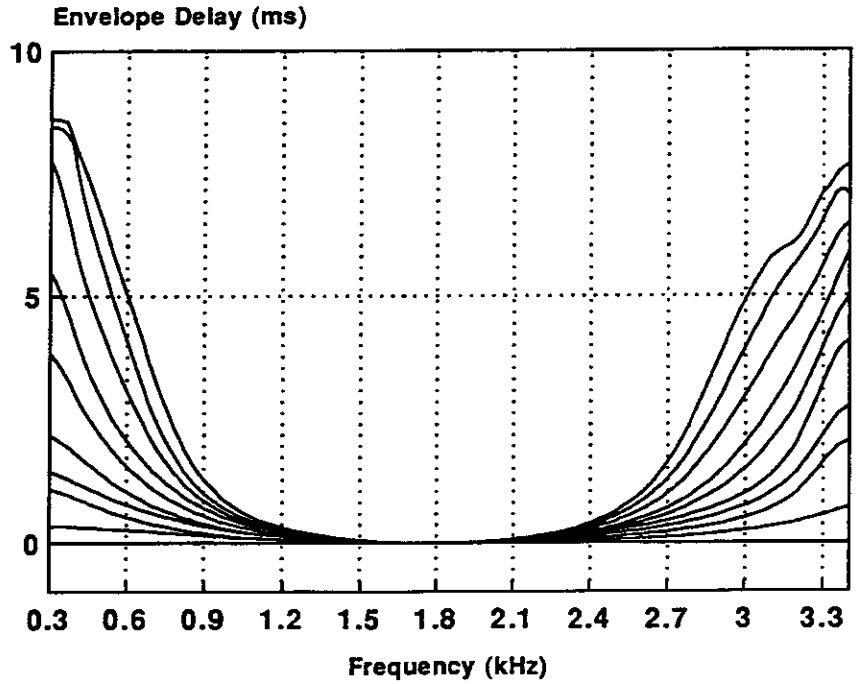
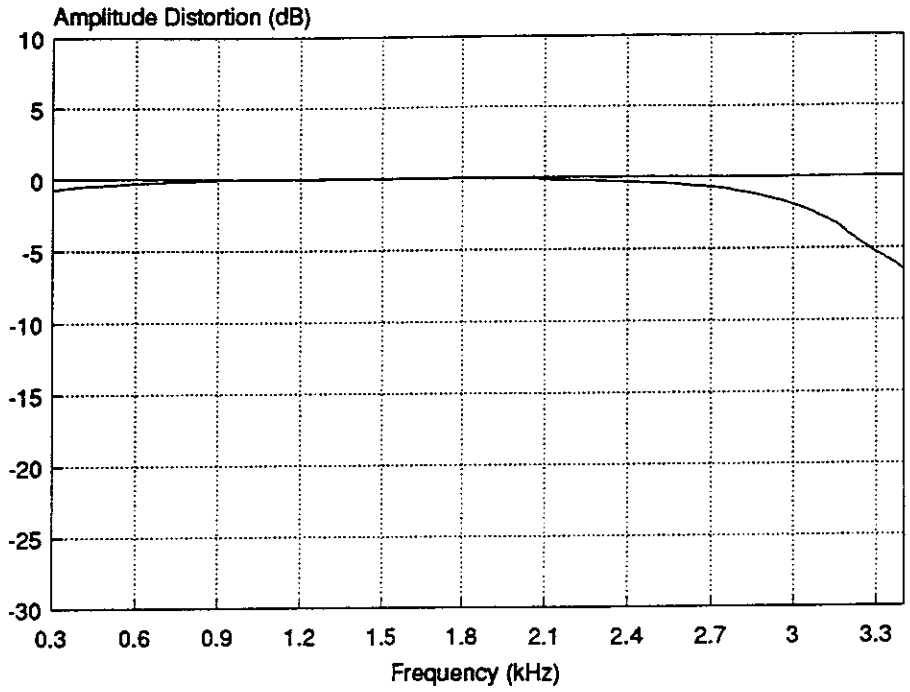


Figure 8: TR30.3-1



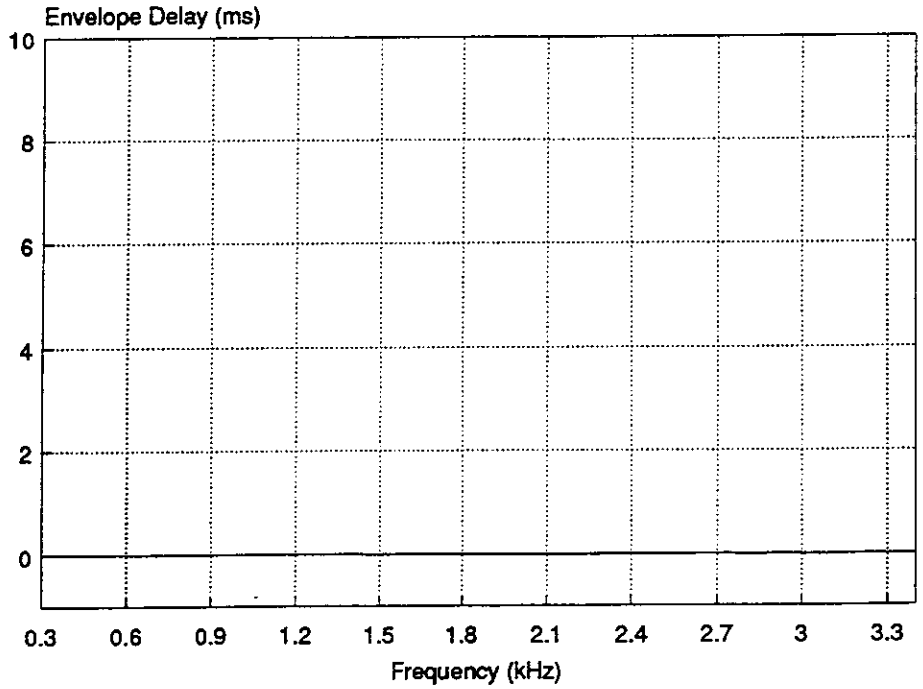
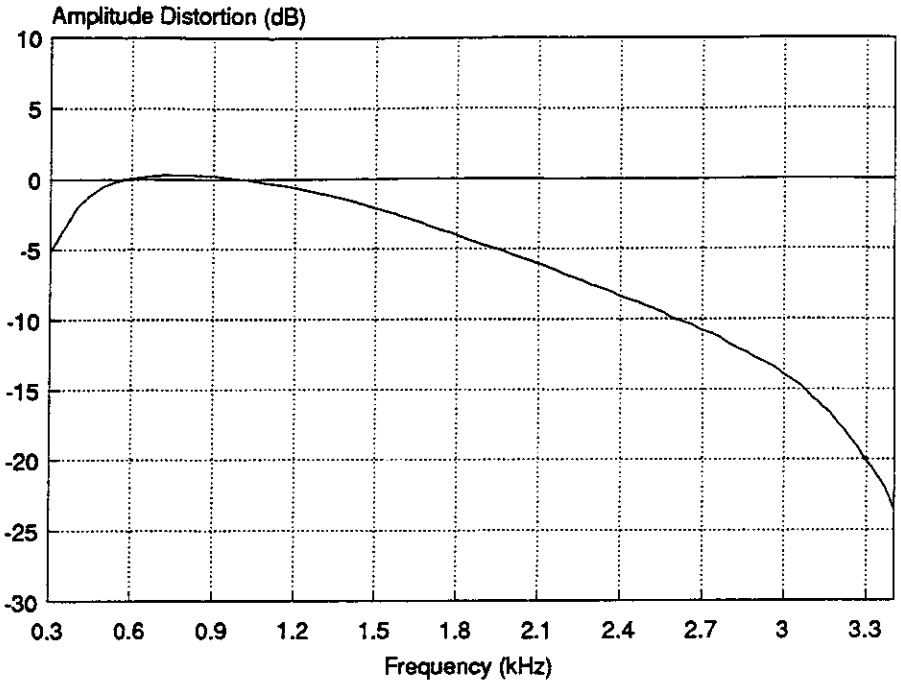


Figure 9: TR30.3-2



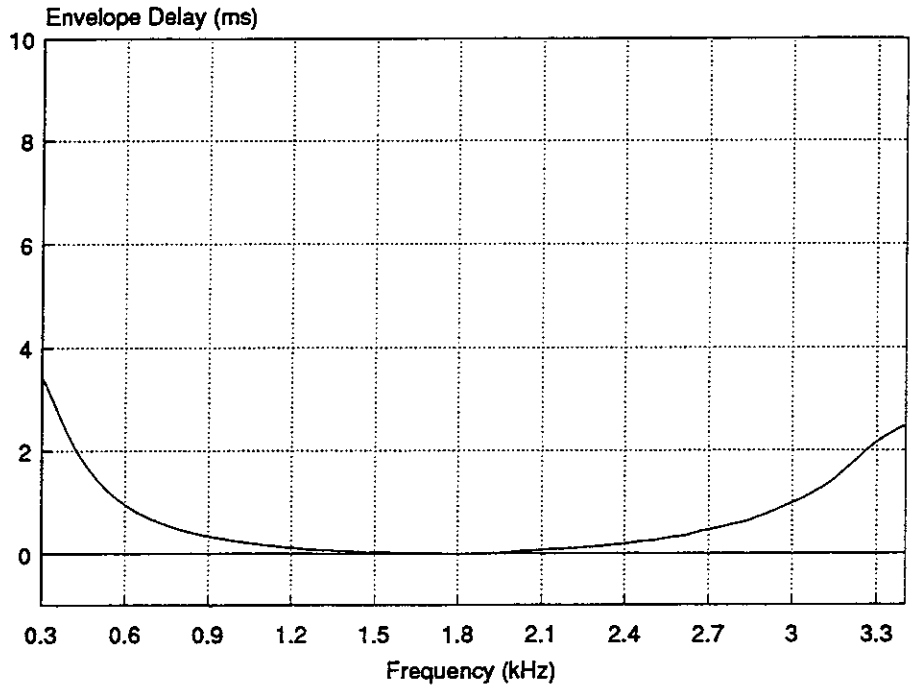
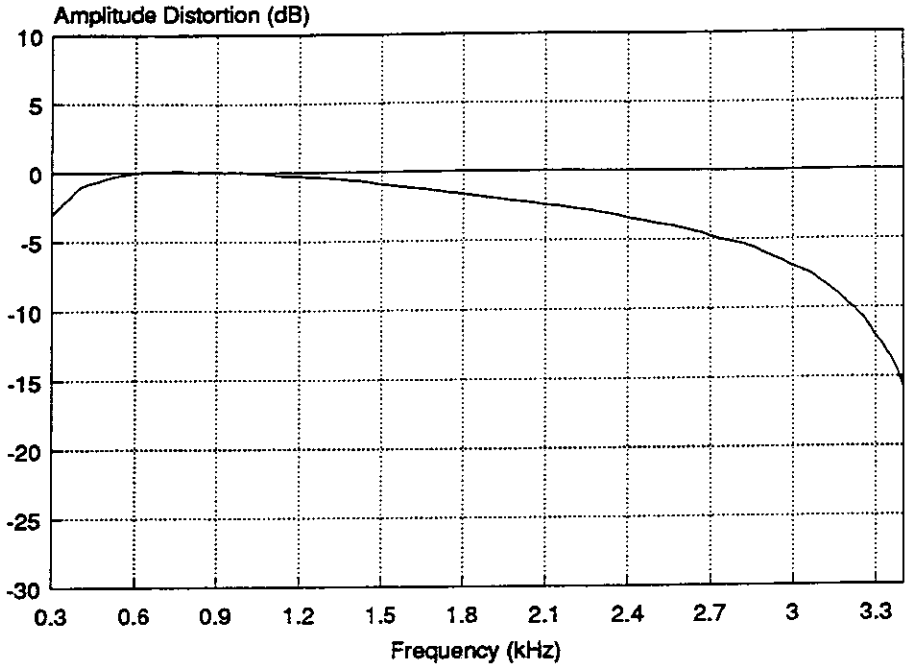


Figure 10: TR30.3-3



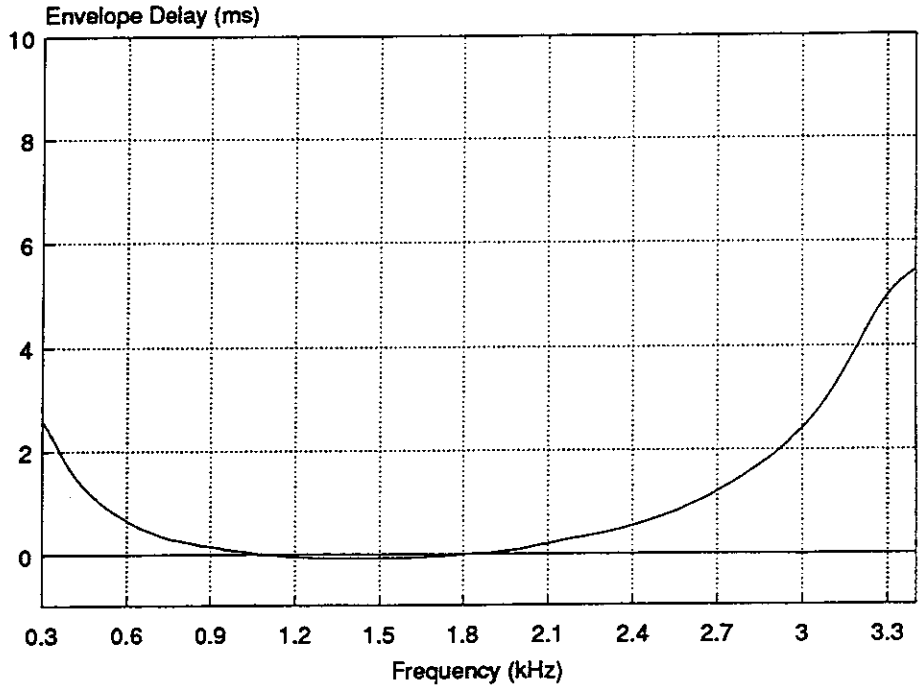
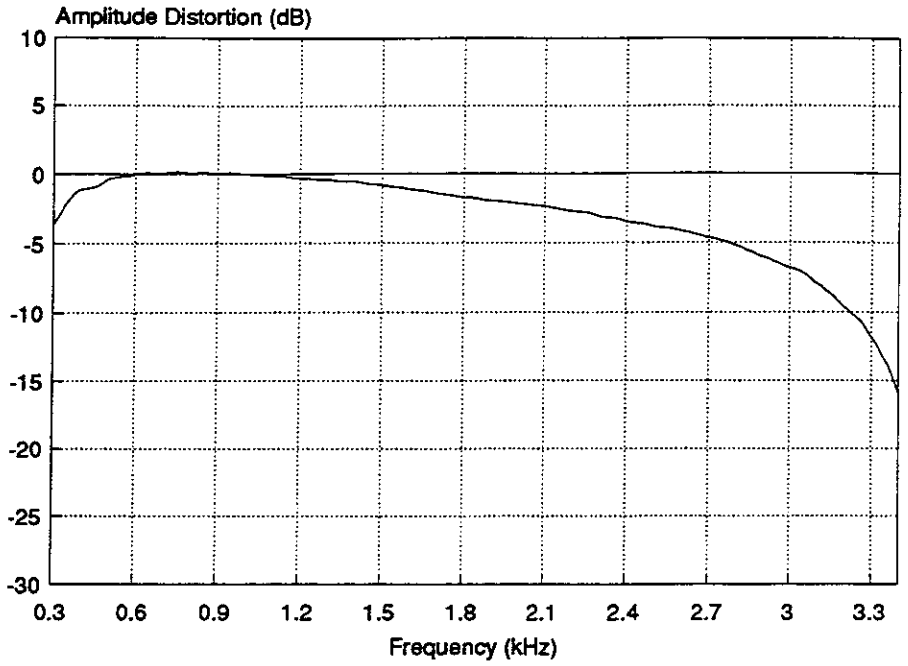


Figure 11: TR30.3-4



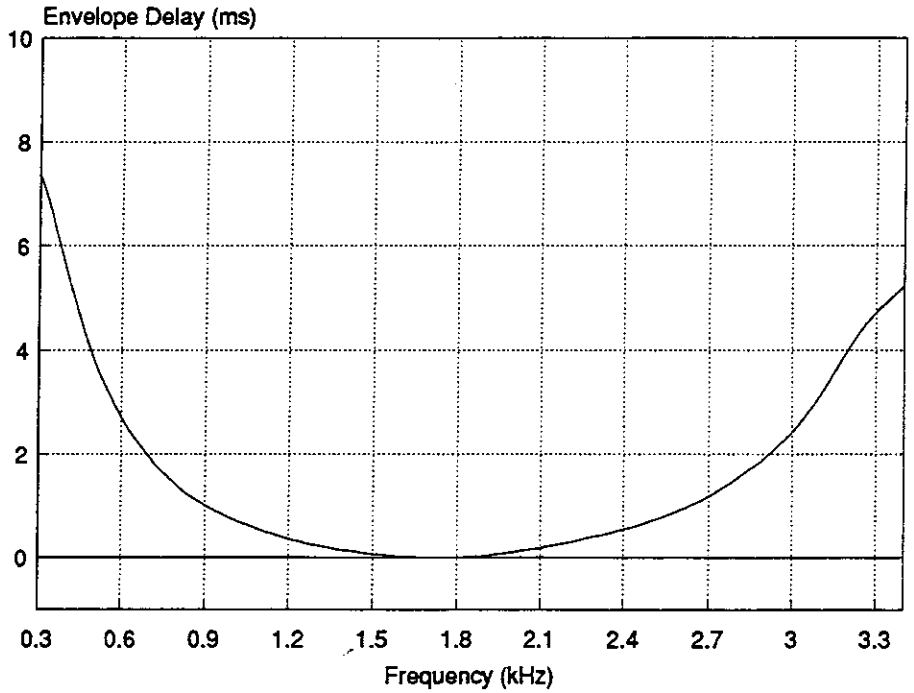
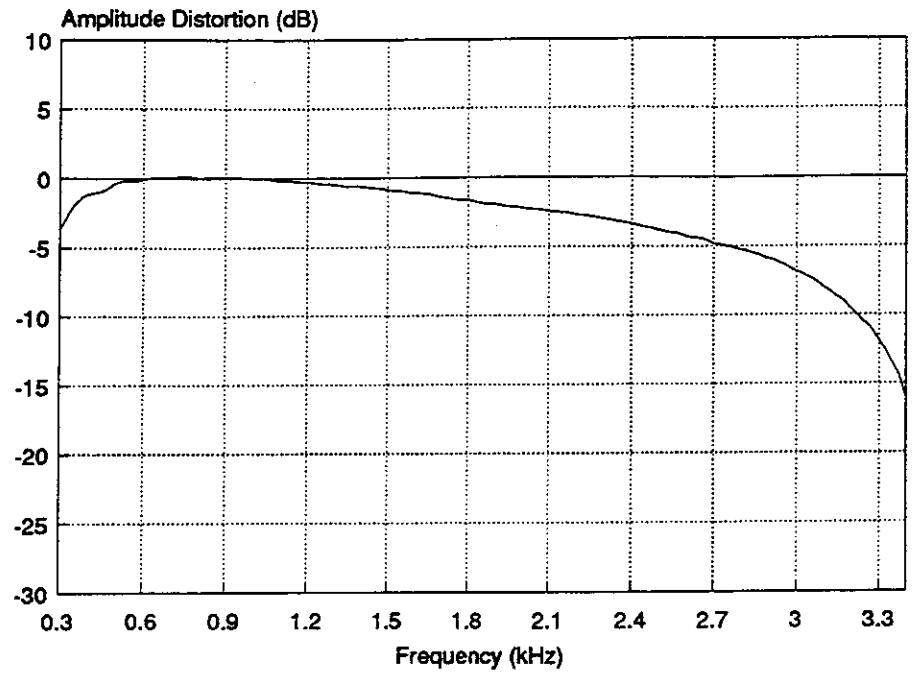


Figure 12: TR30.3-5



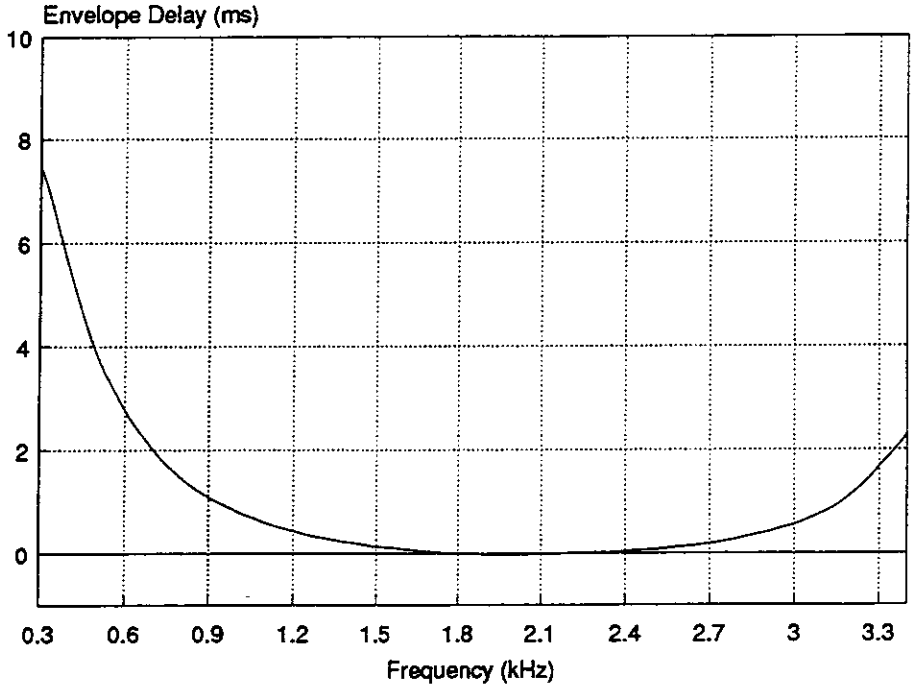
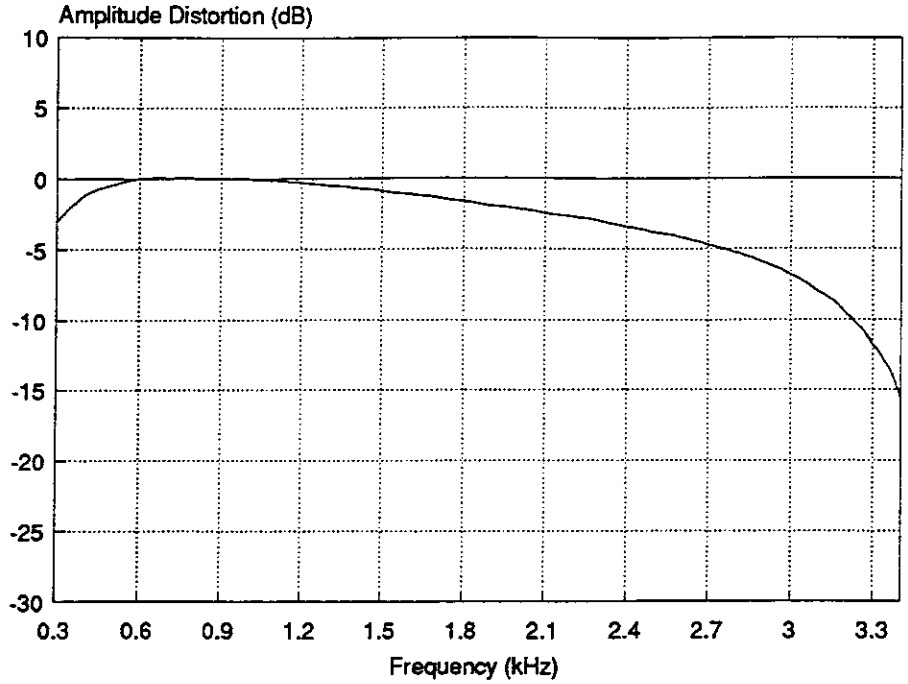


Figure 13: TR30.3-6



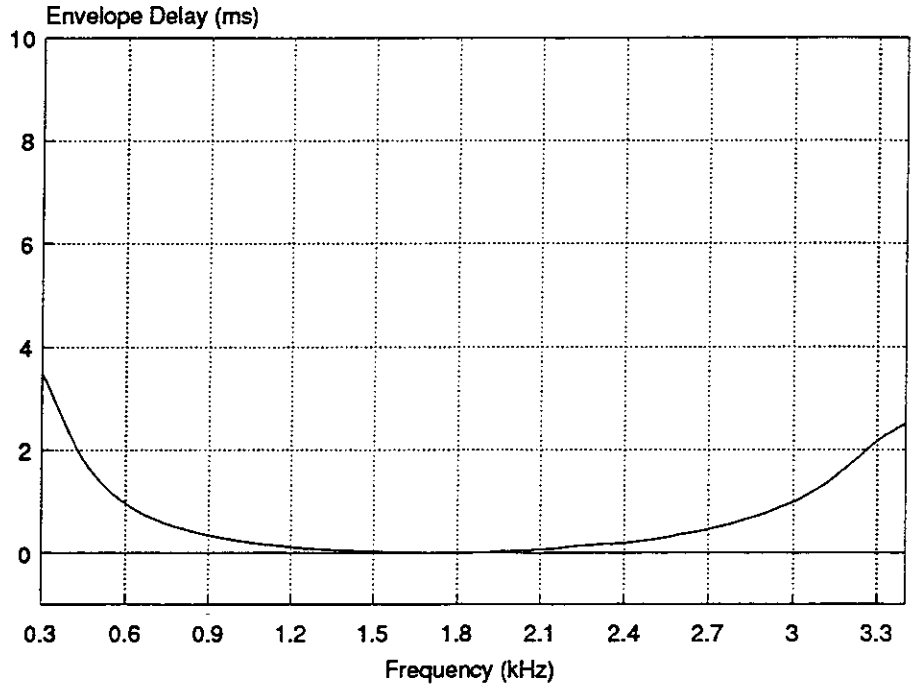
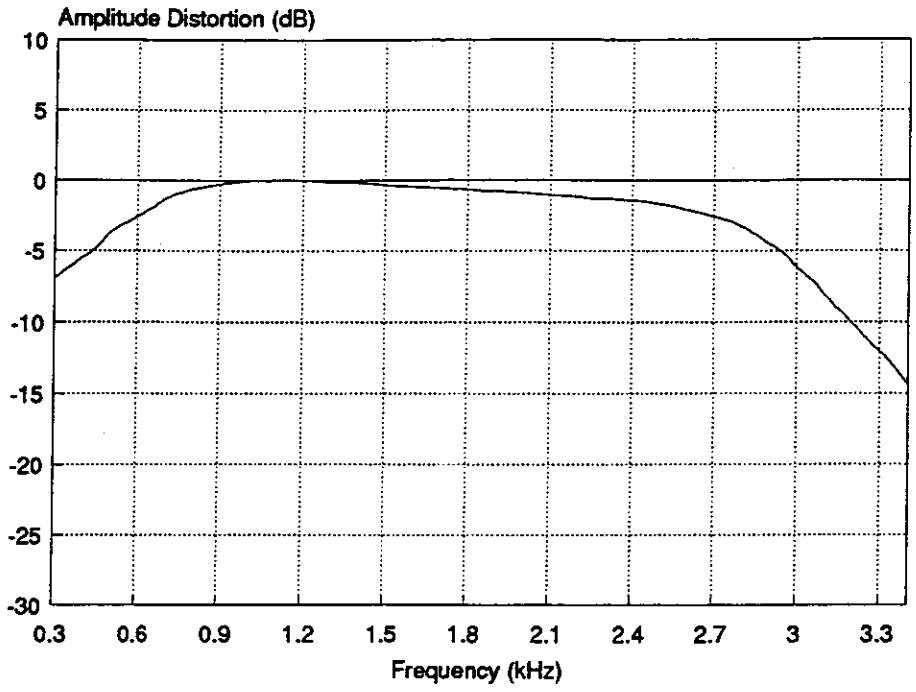


Figure 14: M.1020



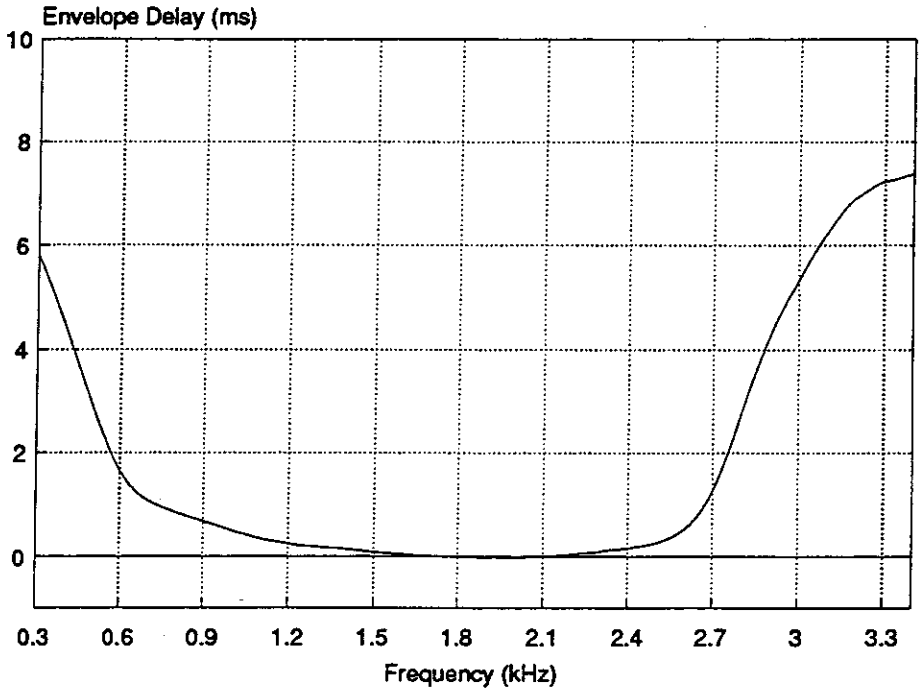
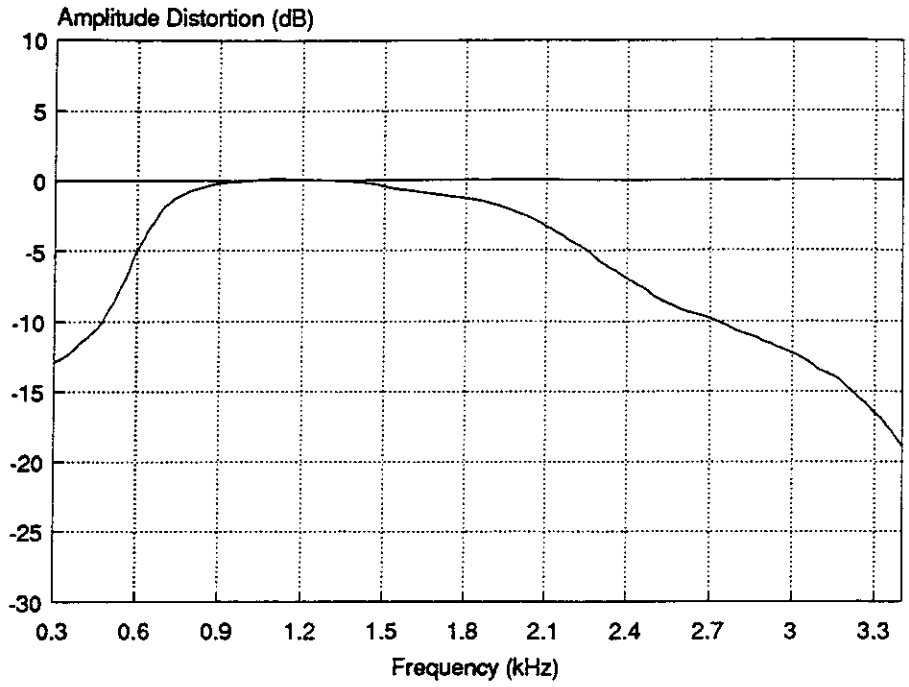


Figure 15: M.1025



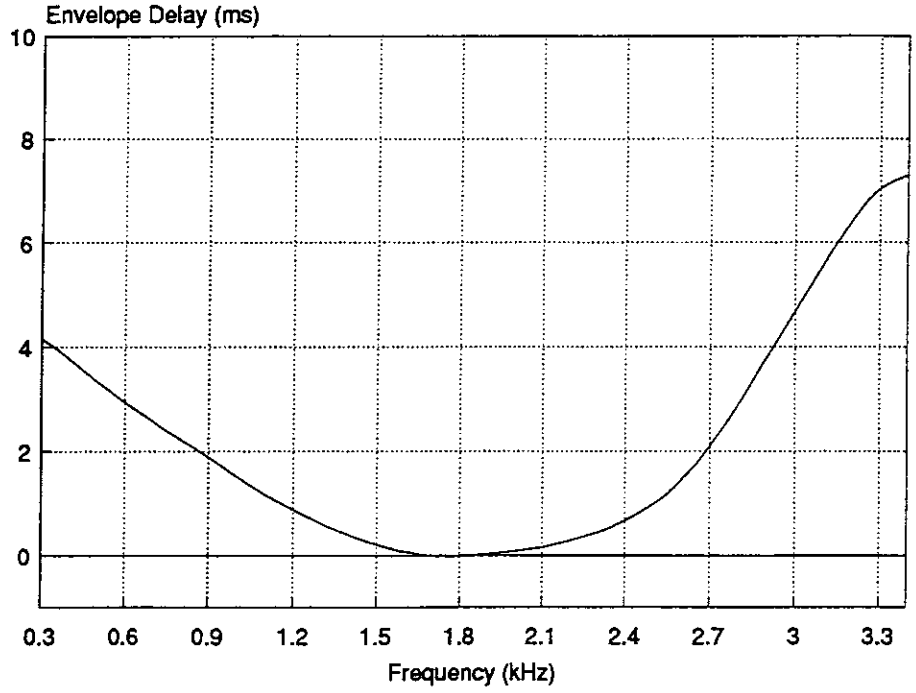
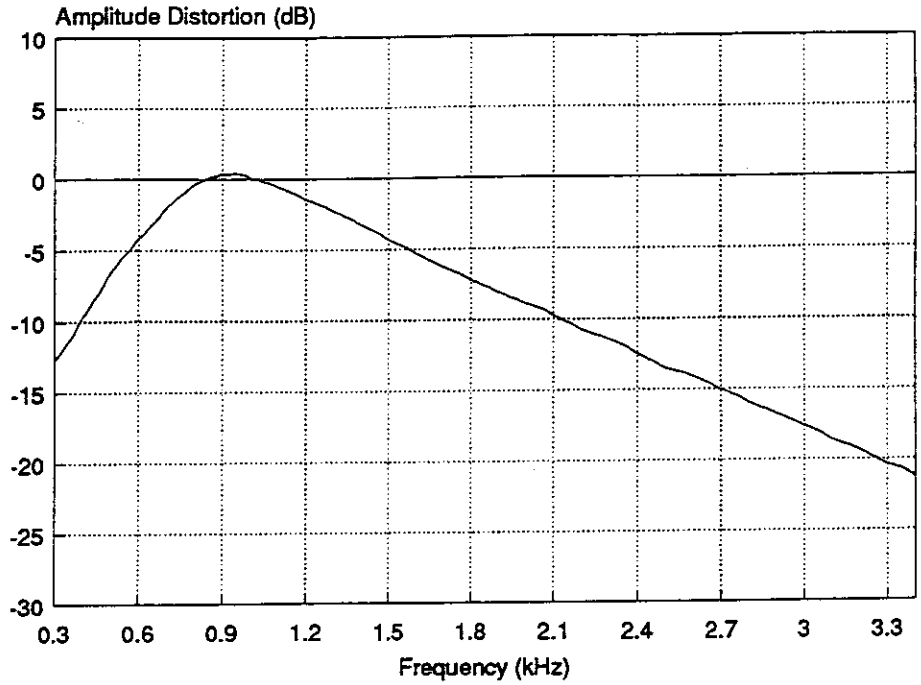


Figure 16: M.1040



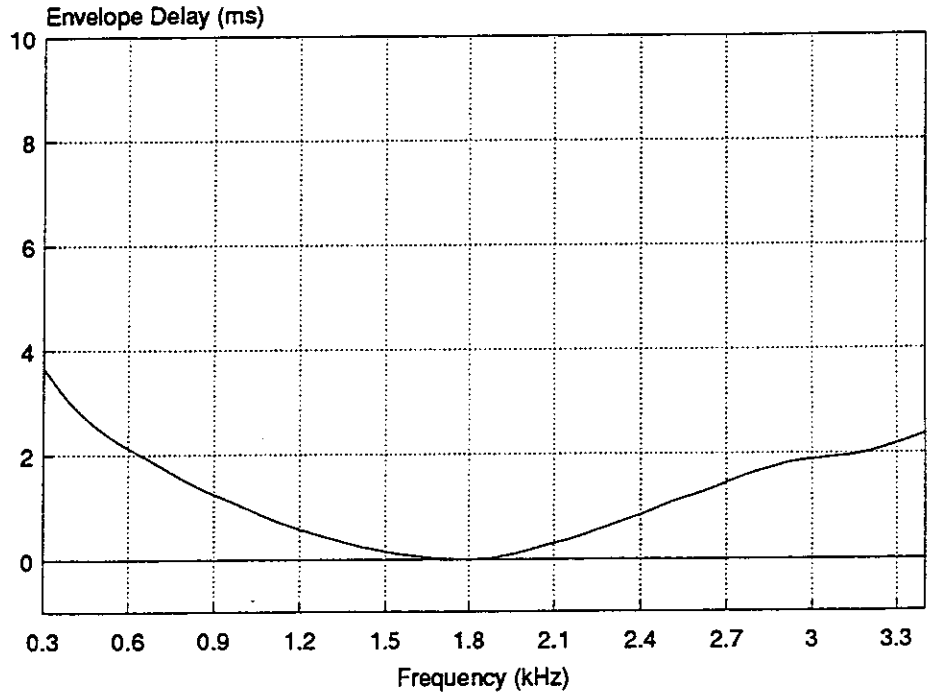
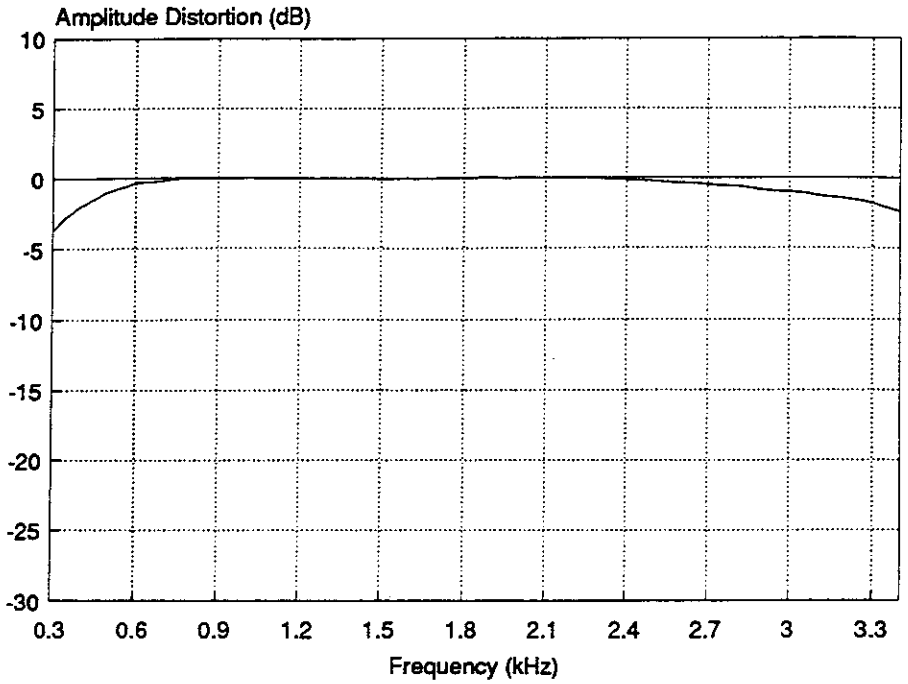


Figure 17: NTT - 1



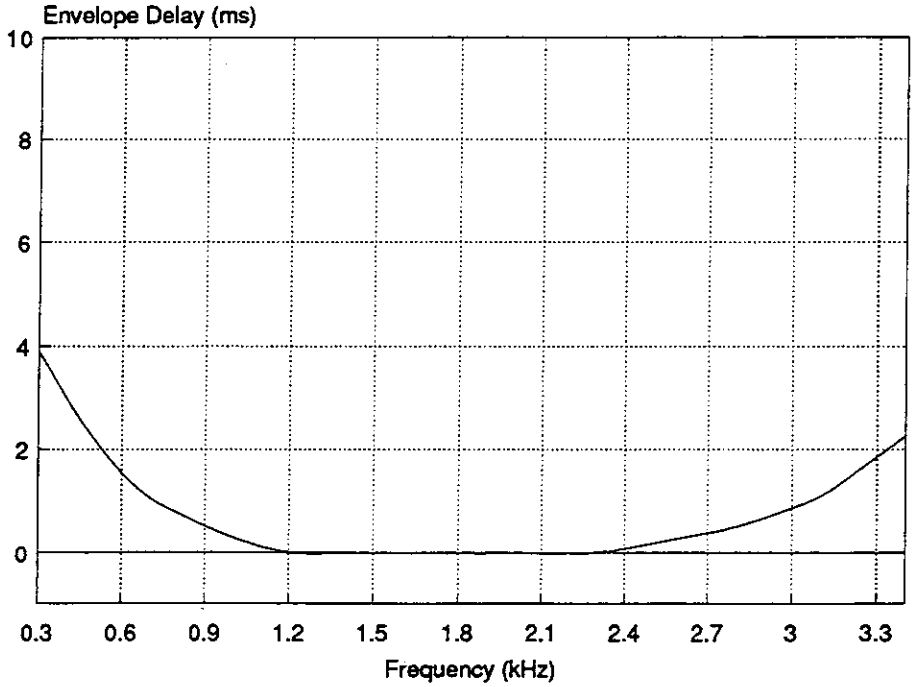
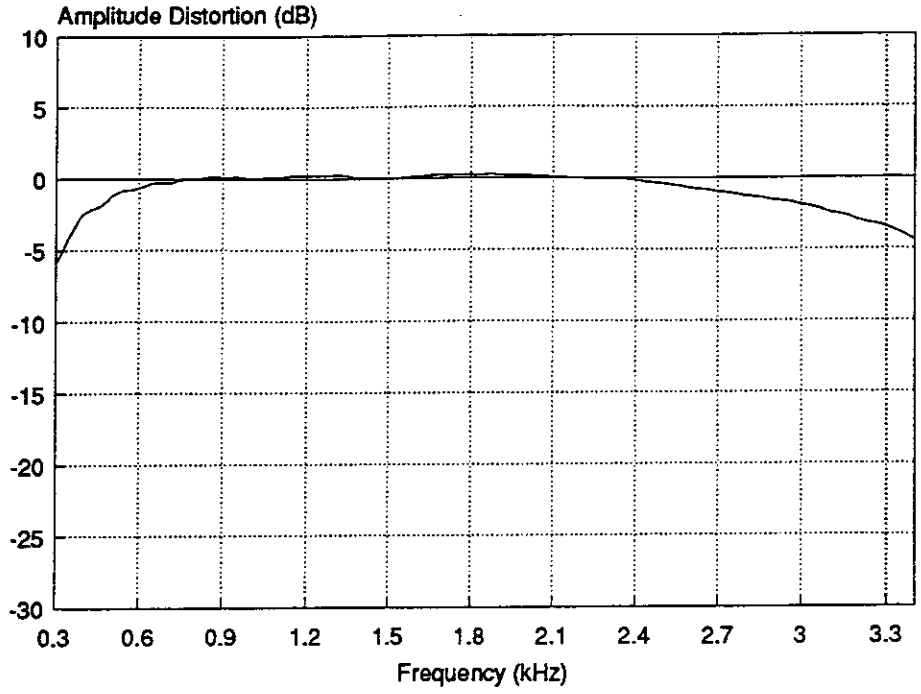


Figure 18: NTT - 2



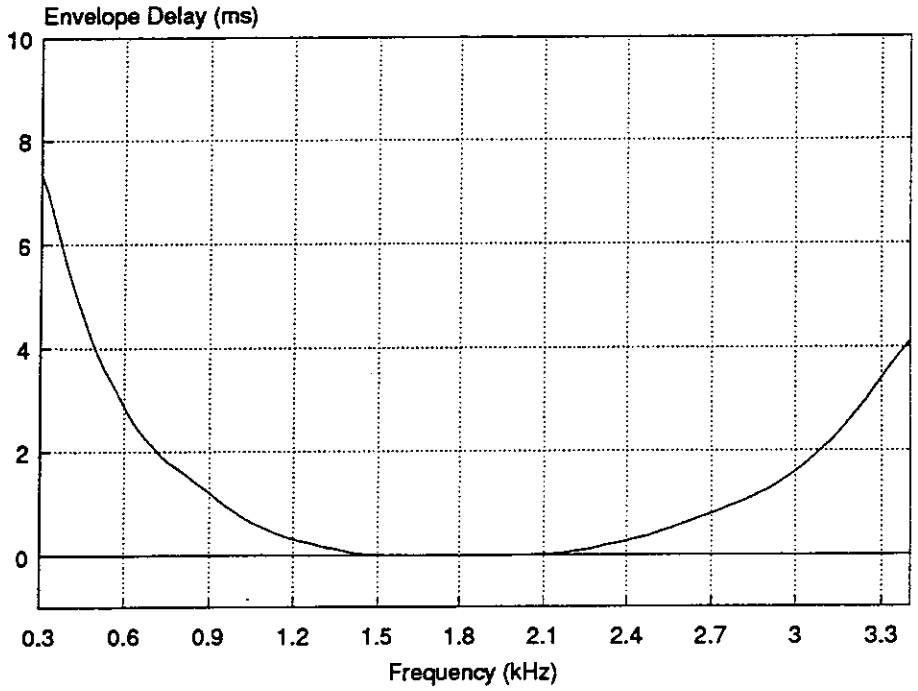
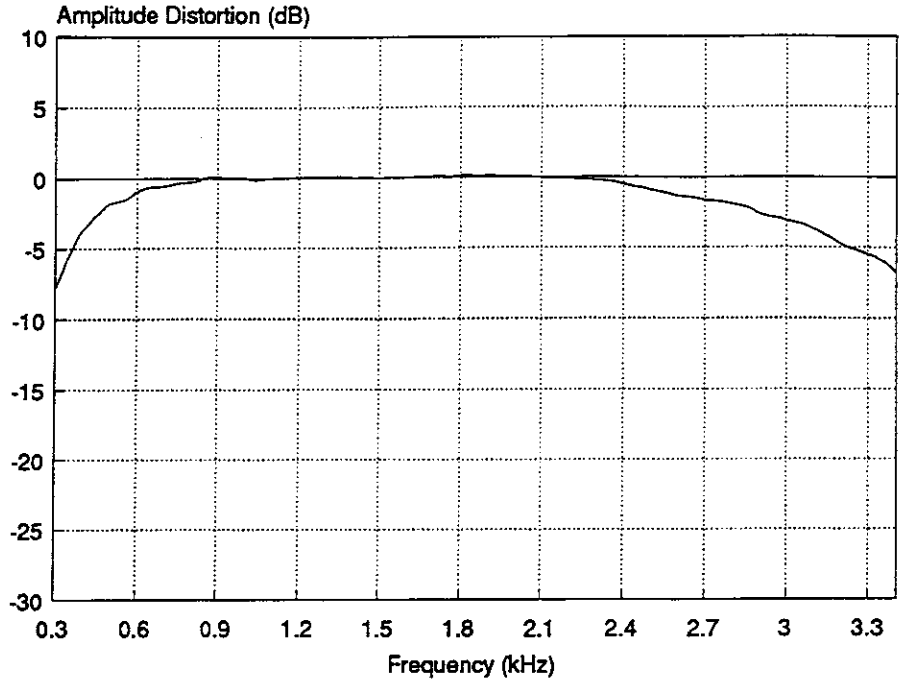


Figure 19: NTT - 3



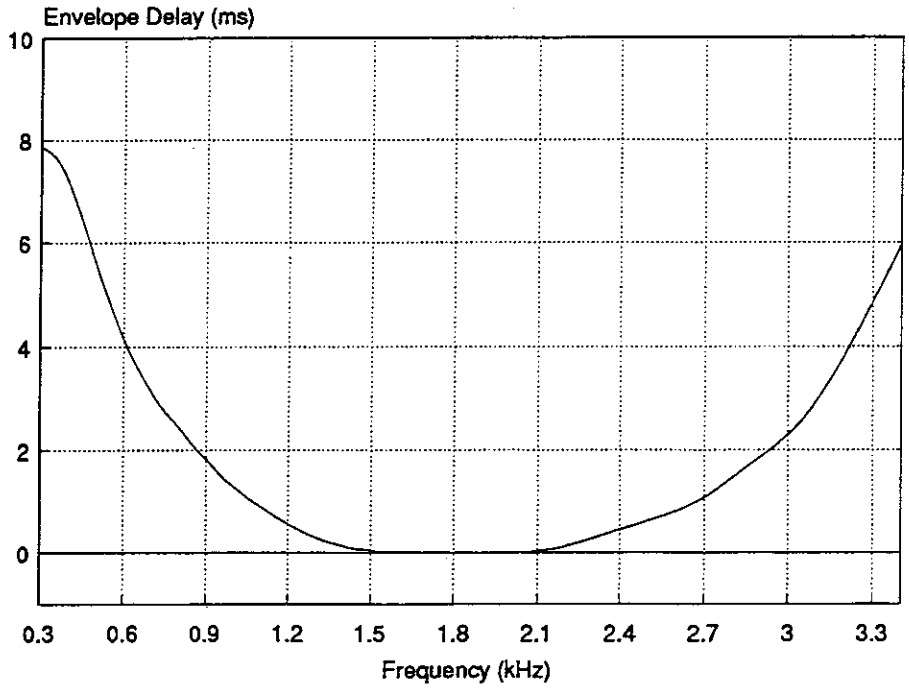
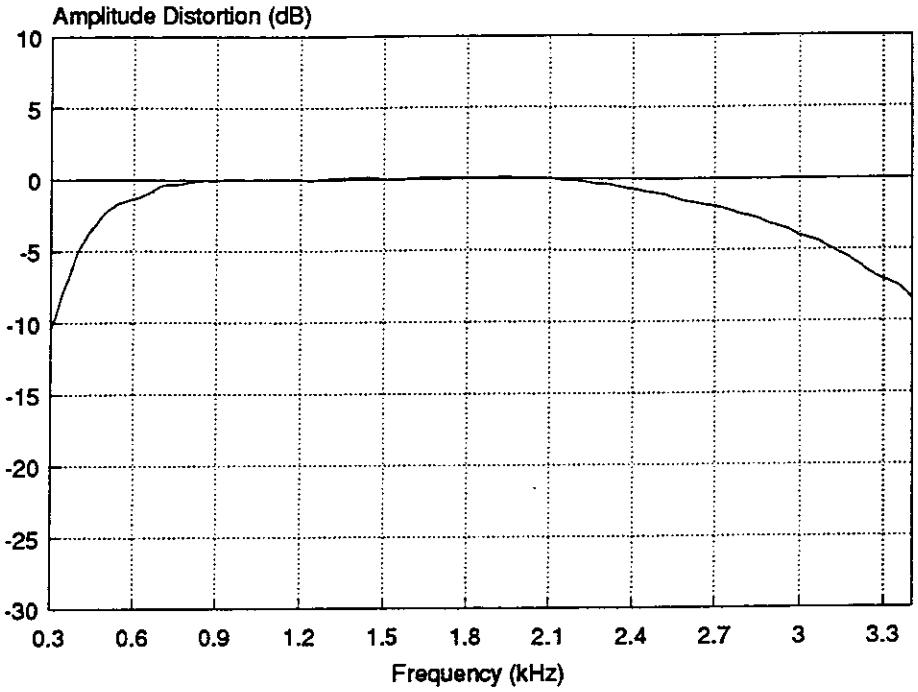


Figure 20: NTT - 4



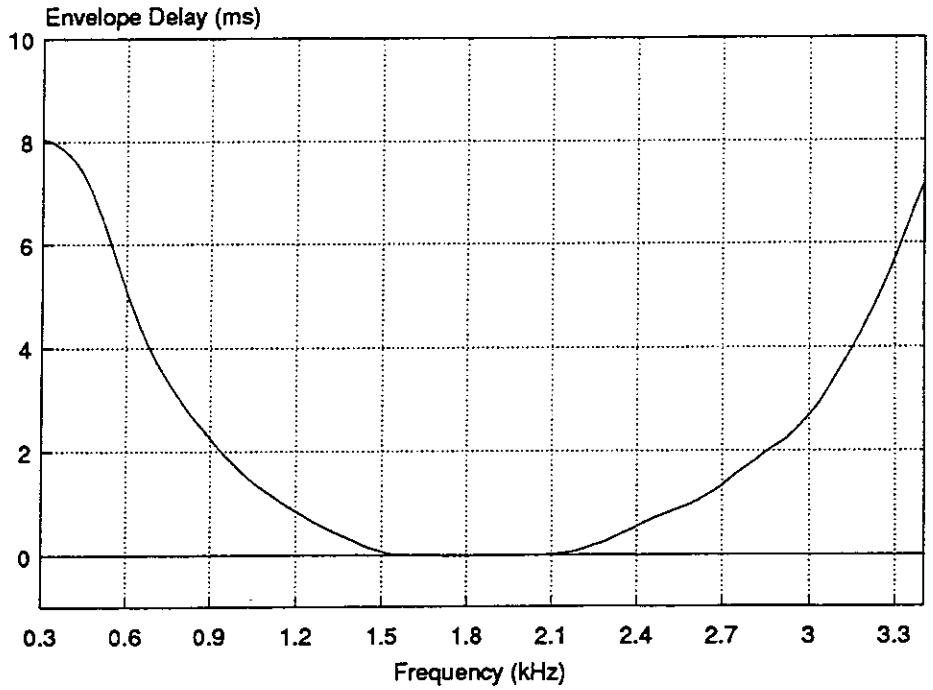
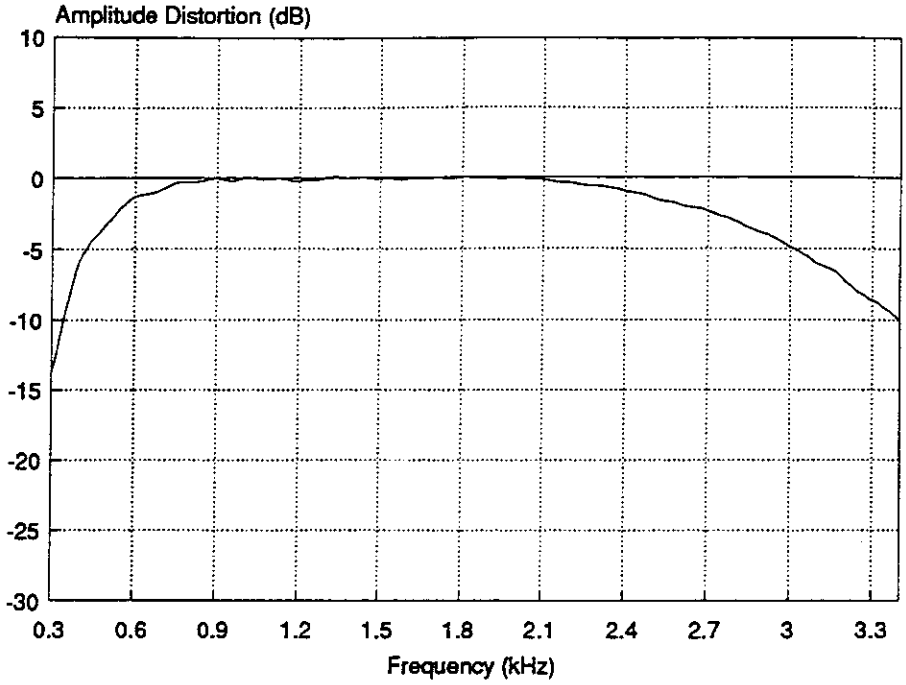


Figure 21: NTT - 5



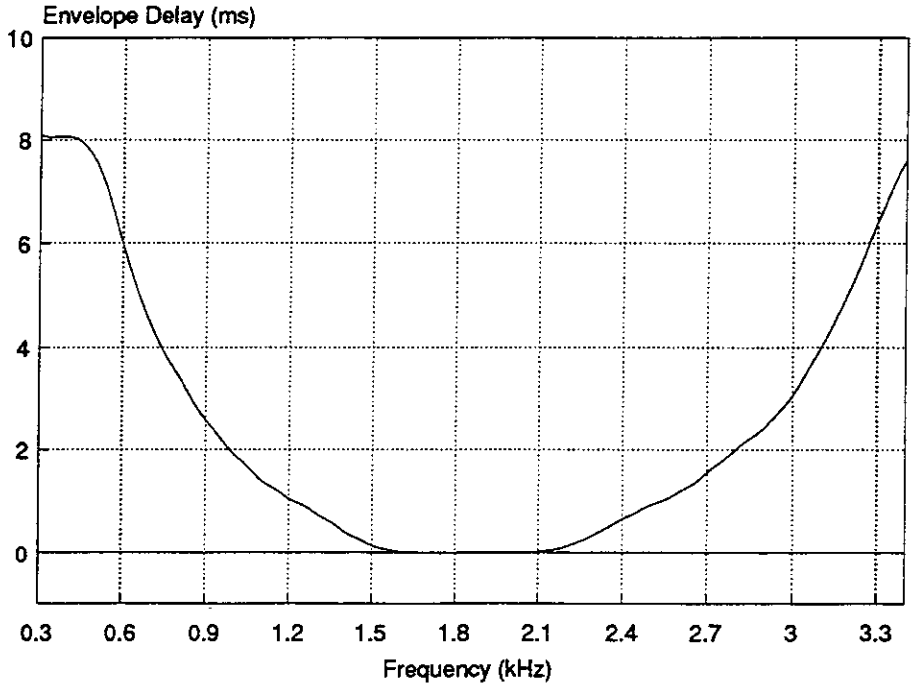
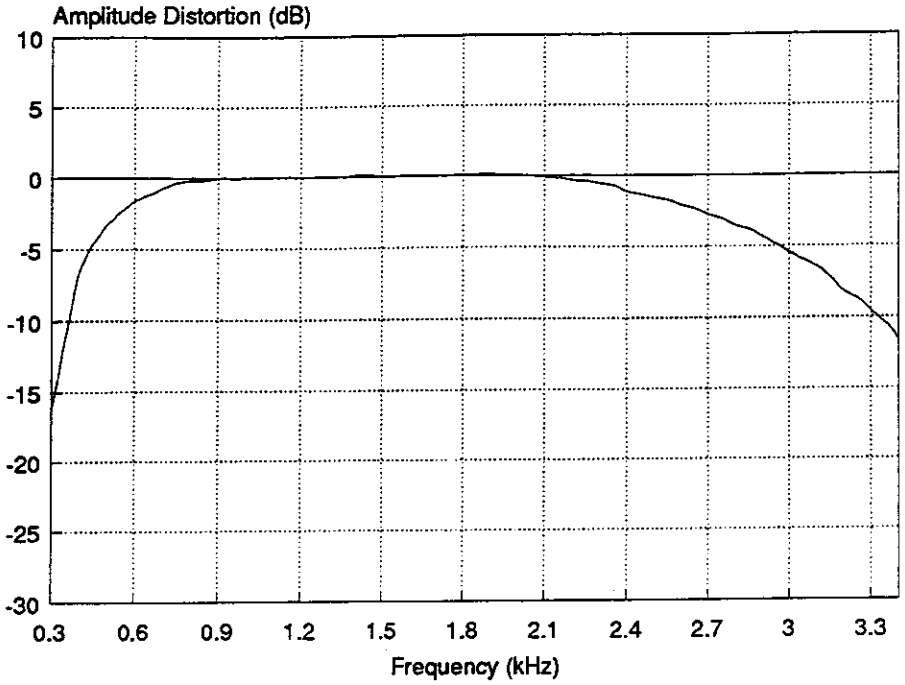


Figure 22: NTT - 6



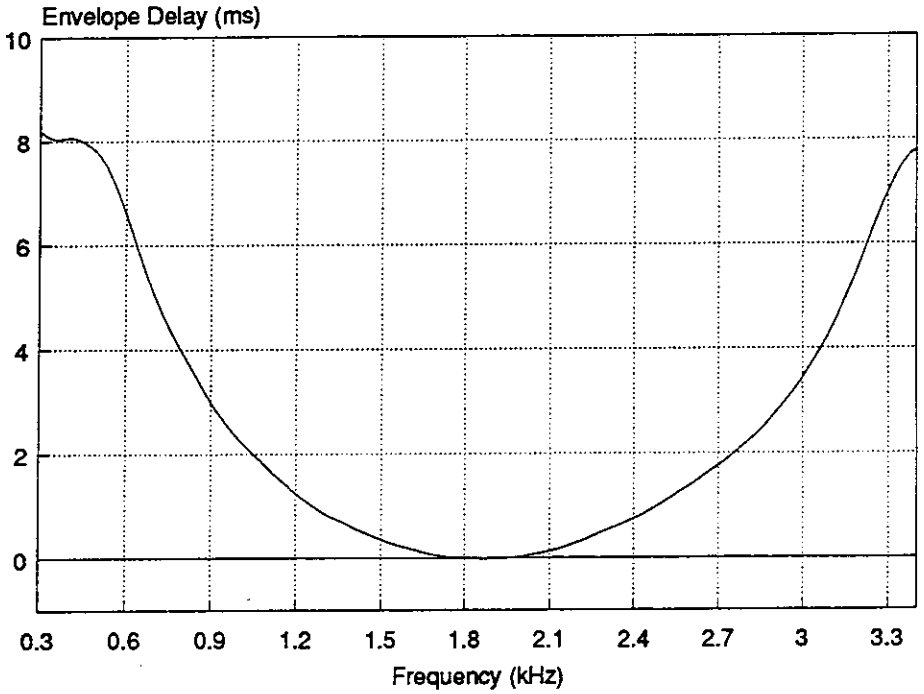
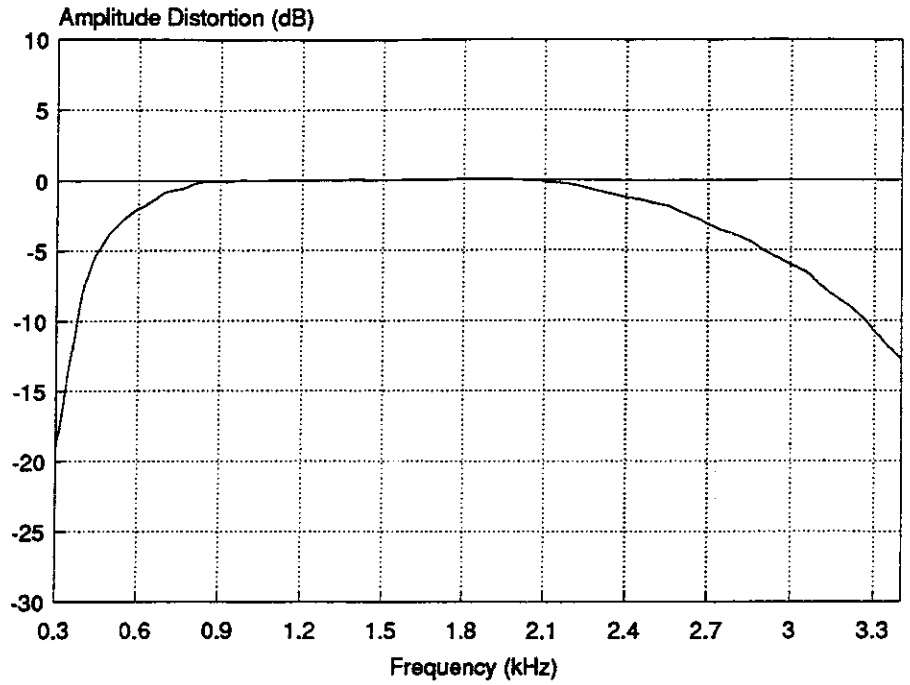


Figure 23: NTT - 7



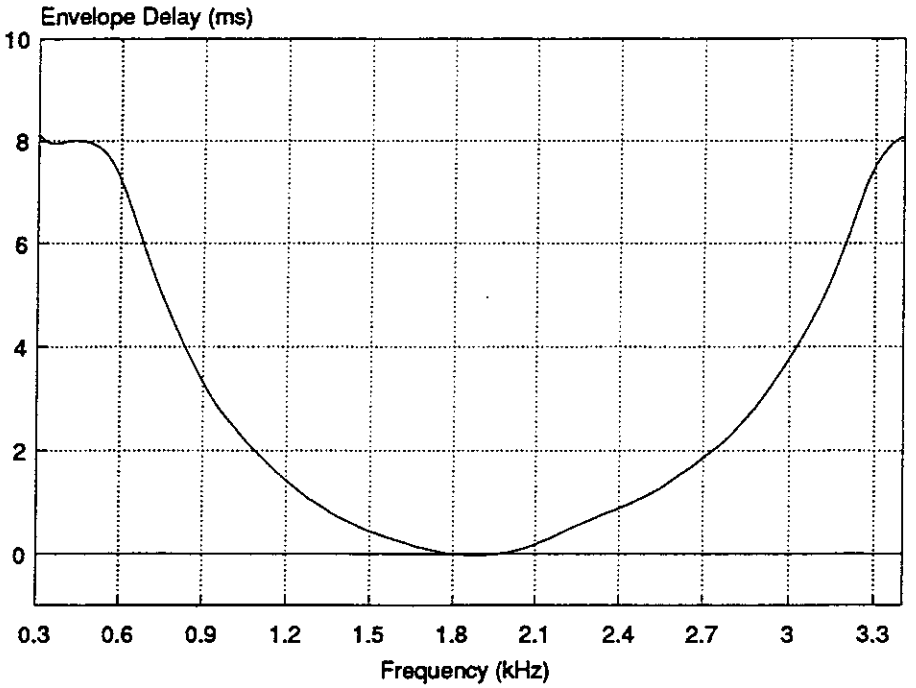
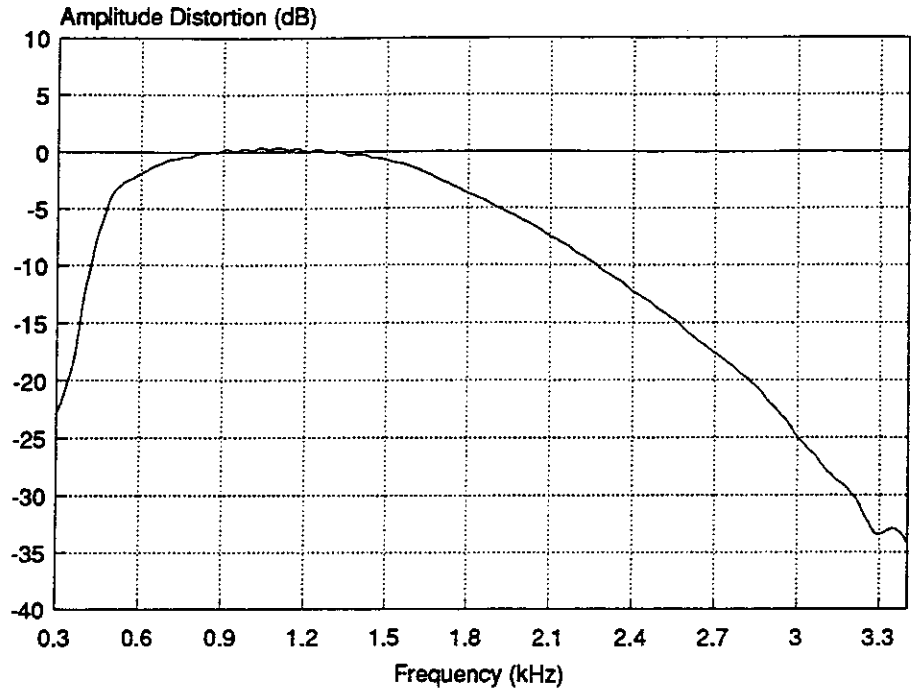


Figure 24: CONUS POOR VOICE



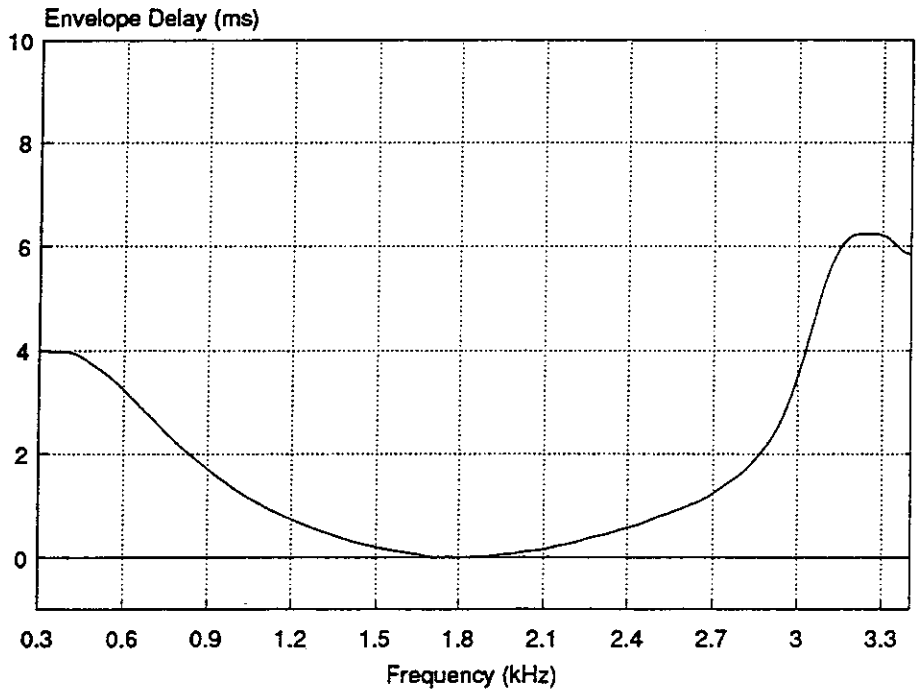
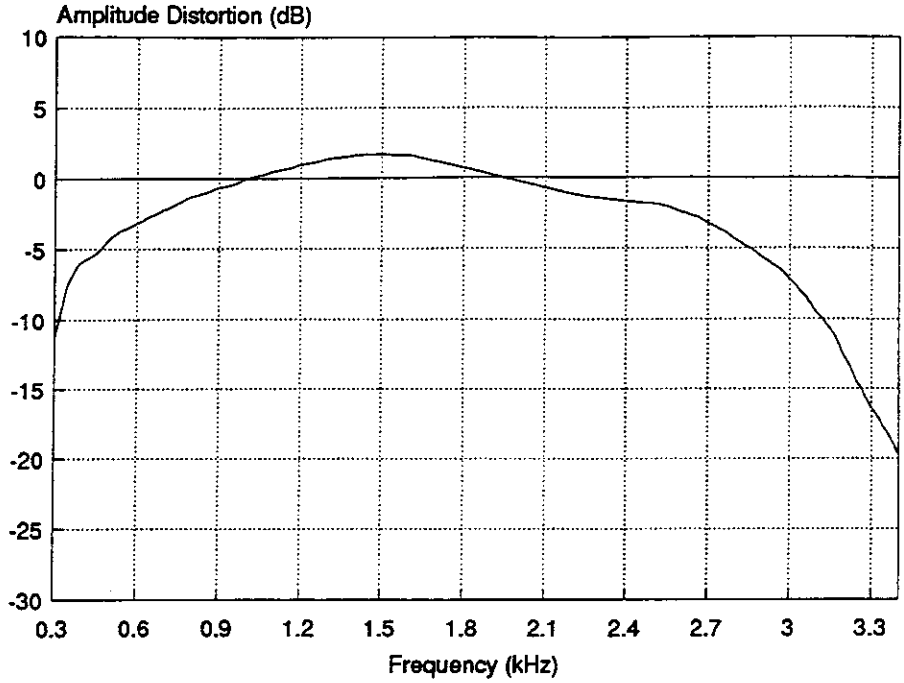


Figure 25: CONUS MID VOICE



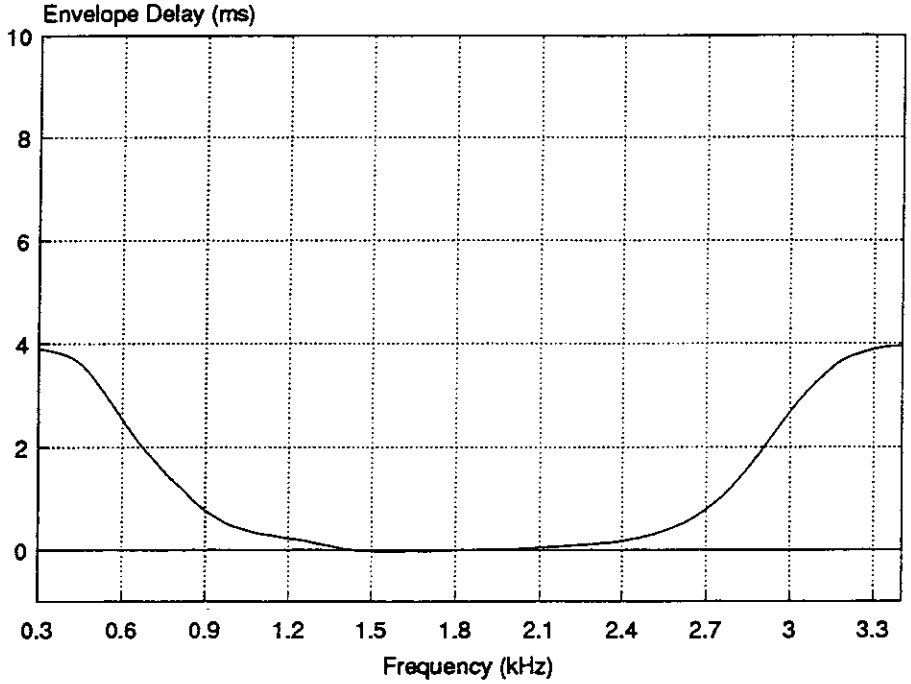
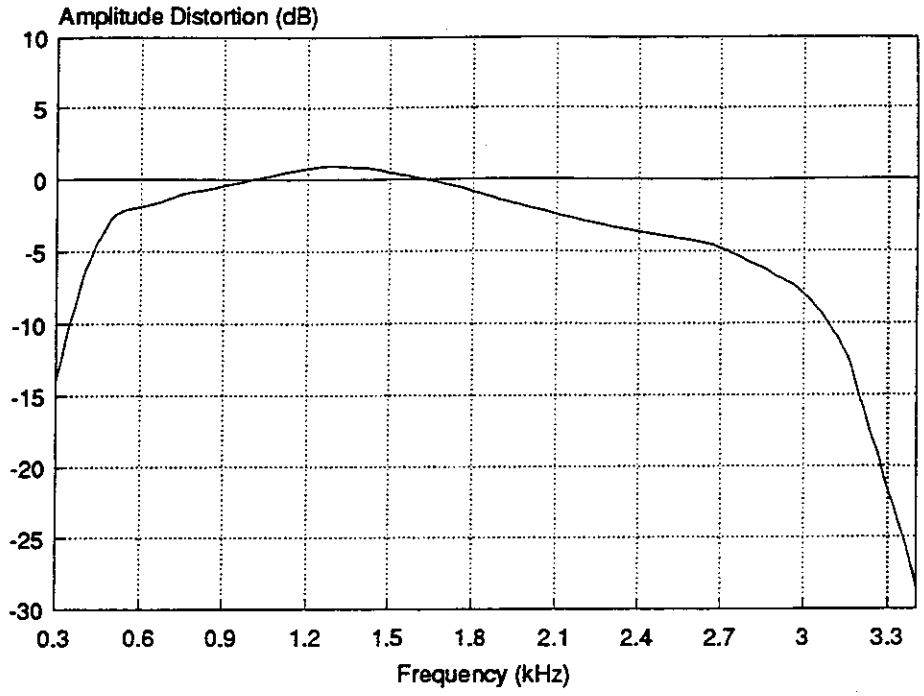


Figure 26: CONUS POOR DATA



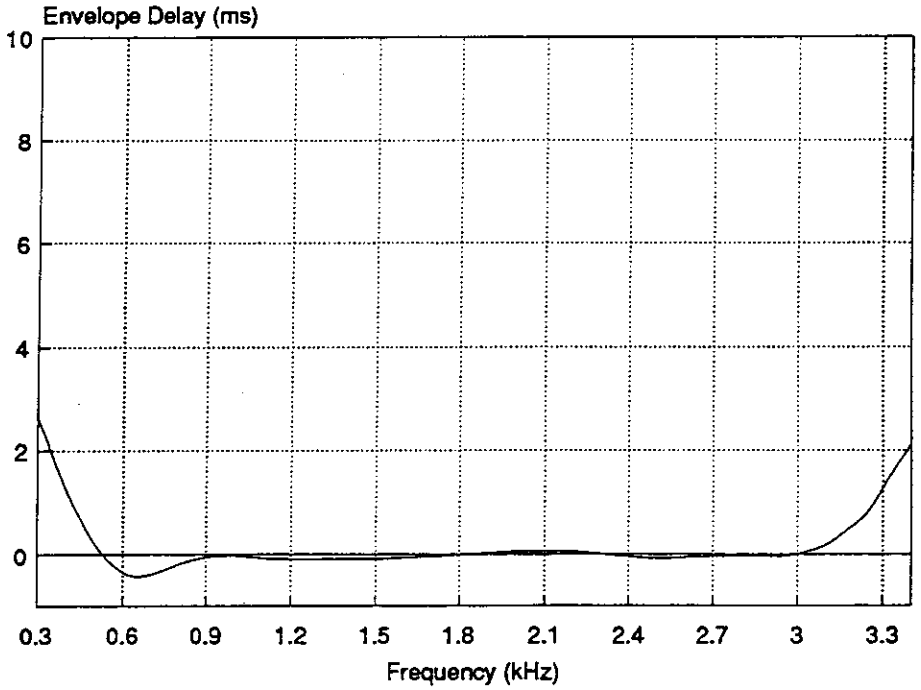
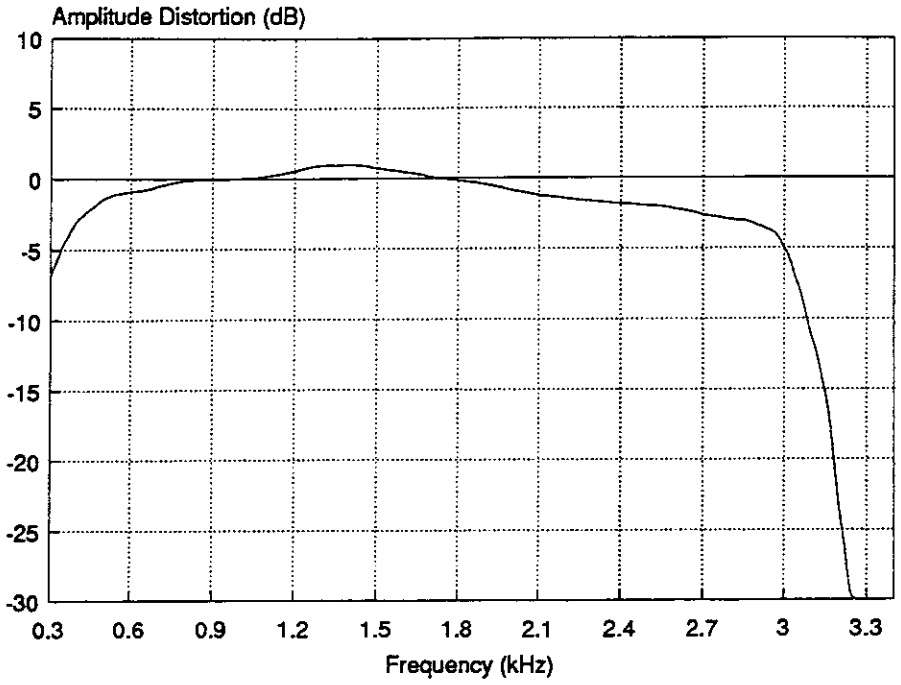


Figure 27: CONUS MID DATA



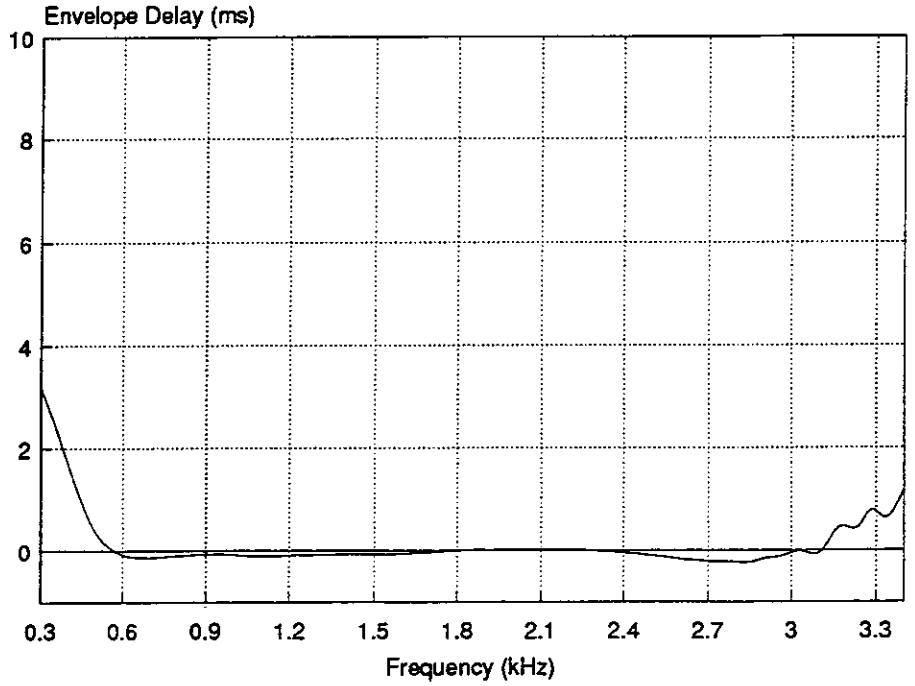
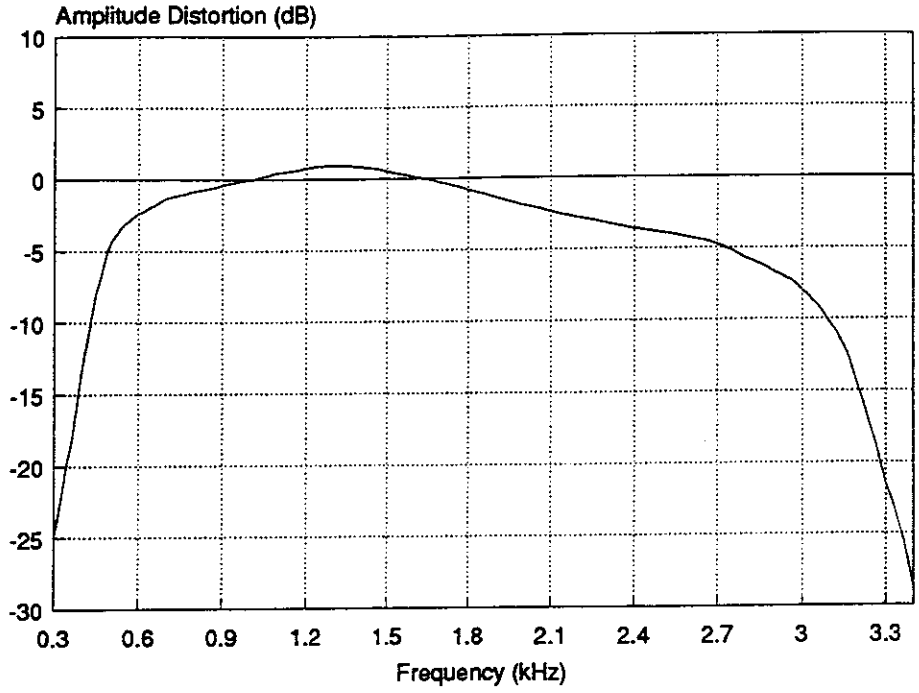


Figure 28: EUROPEAN POOR VOICE



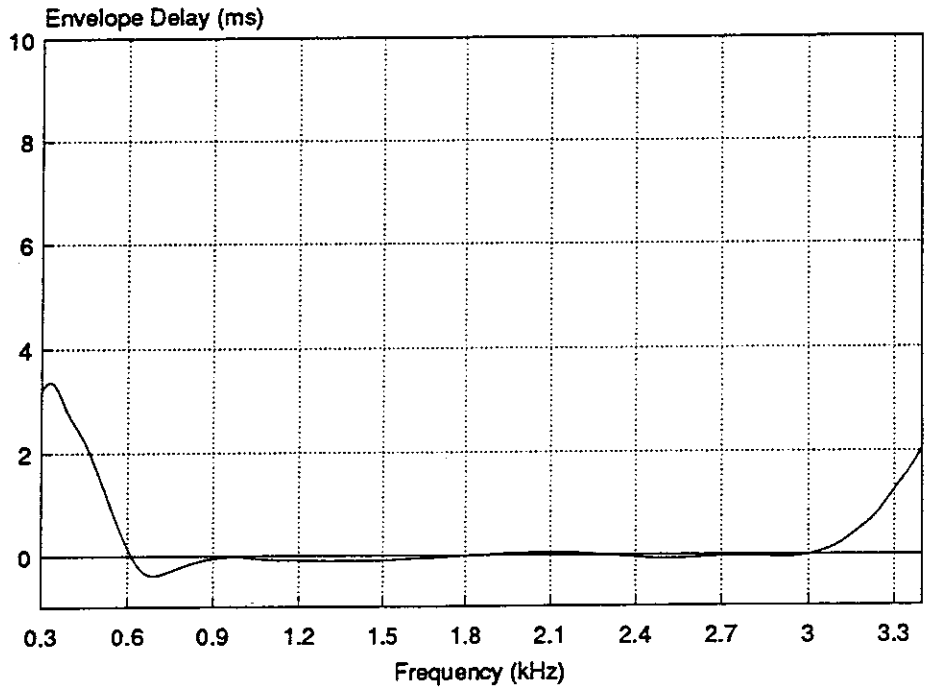
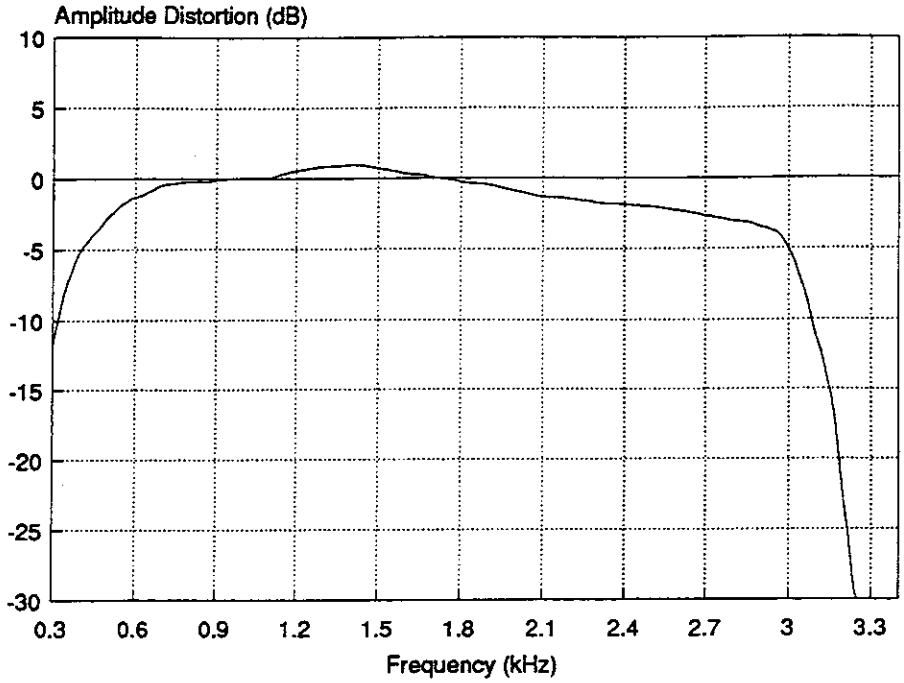


Figure 29: EUROPEAN MID VOICE



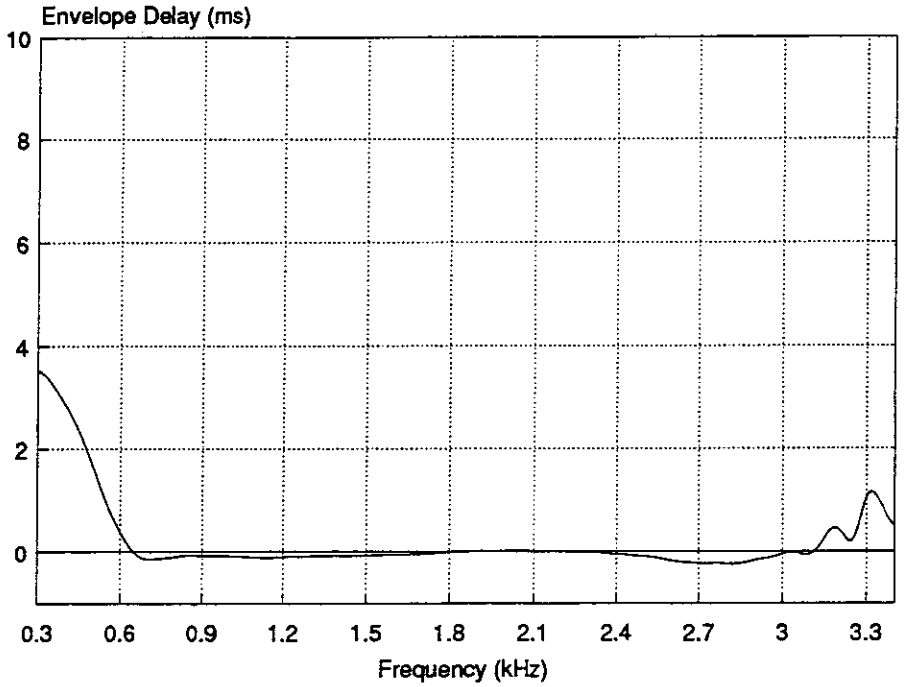
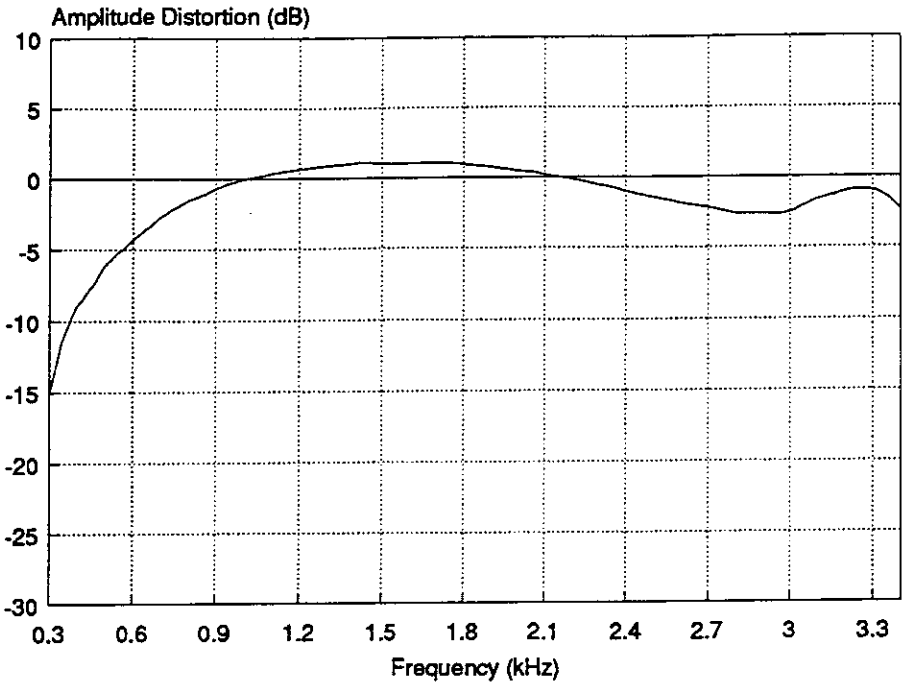


Figure 30: EUROPEAN POOR DATA



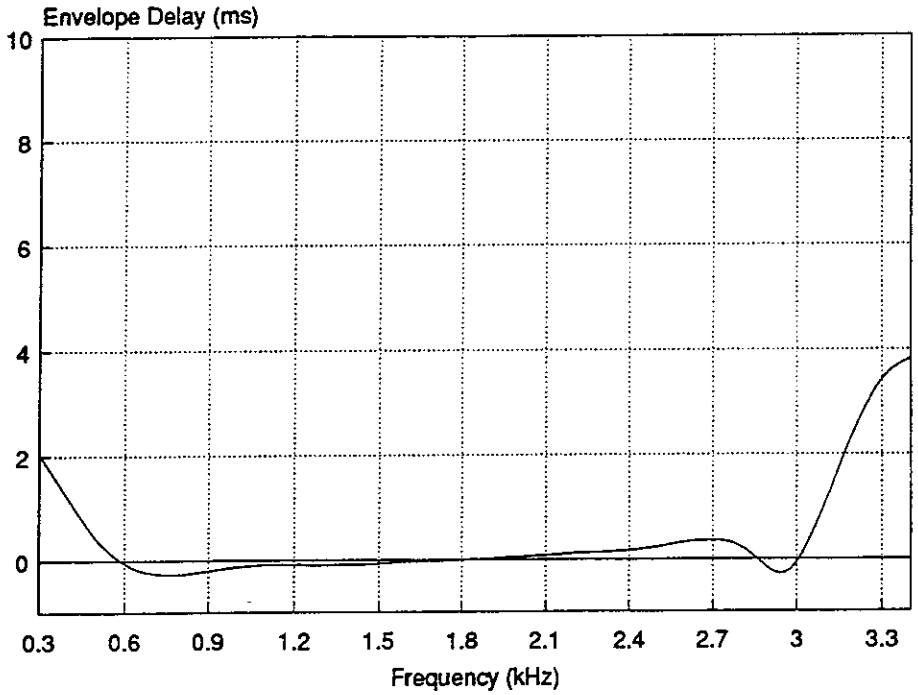
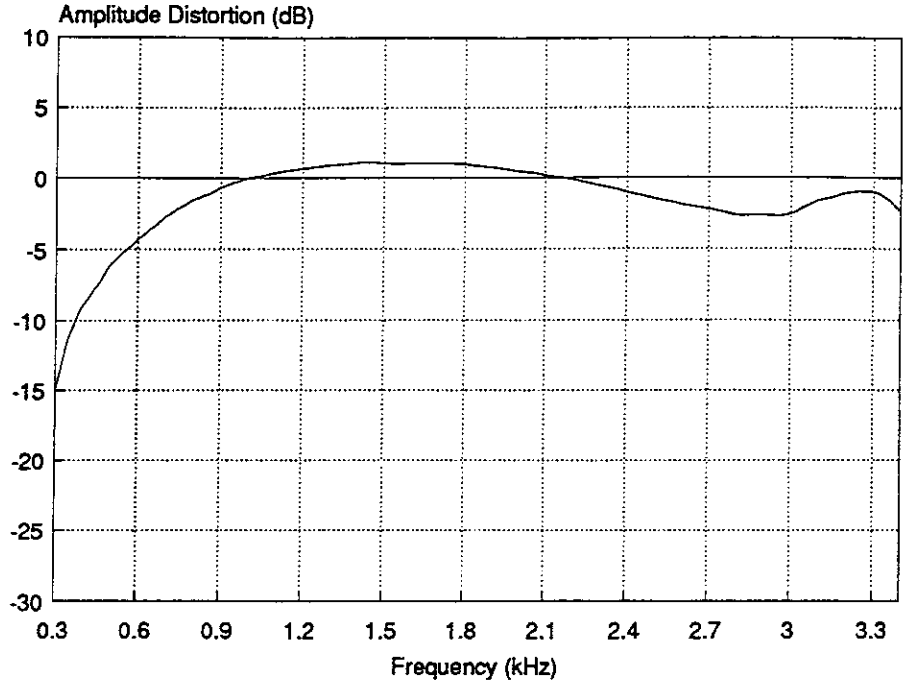
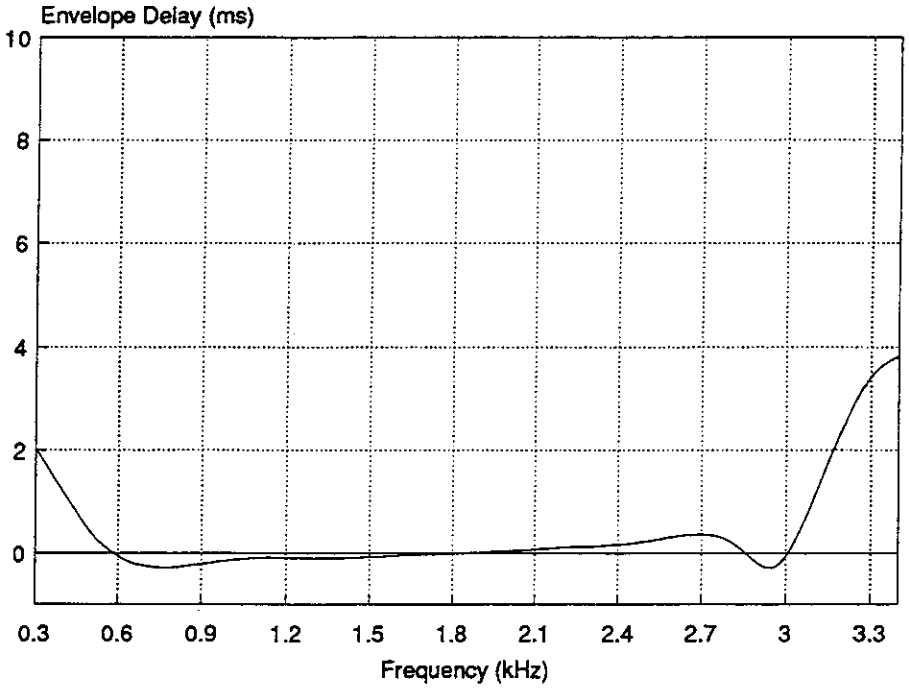


Figure 31: EUROPEAN MID DATA





SECTION 7 - APPLICATIONS

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UNIT CONFIGURATIONS FOR COMMON USES

The common network configurations available with the 5102 include 2-Wire Switched, 2-Wire Leased, and 4-Wire Leased. Each mode requires a different configuration in the 5102 and different connections to the Port Interfaces. The following checklists provide a quick verification that the critical parameters are specified correctly.

2-Wire Switched Network	Loop Current A and B	-	25 mA (or any non-zero value)
	CO Simulation	-	Enabled
	Line Option	-	2-Wire RJ11 or 2-Wire RJ45
	All other parameters	-	default or user defined
2-Wire Leased	Loop Current A and B	-	0 mA
	CO Simulation	-	Disabled
	Line Option	-	2-Wire RJ11 or 2-Wire RJ45
	All other parameters	-	default or user defined
4-Wire Leased	Line Option	-	4-Wire RJ45
	All other parameters	-	default or user defined

Note: *For correct operation in any of the three modes, verify that the Telco Cables used are connected to the correct Port Interface. The front panel LED illumination indicates which interface is active, the RJ11 or the RJ45.*

It should be verified that the Telco Cables used are not reverse cables. A reverse cable will have the Red/Green pair of wires in the middle of the modular jack on one end, with the Yellow/Black pair in the middle at the other end.

5102 GENERAL WARNINGS

These are a few general operational restrictions that must be observed when using the PTT 5102:

1. Before turning on the power, verify that the voltage selector displays the correct voltage being used. Use of incorrect voltage can damage the equipment.

2. Power In must be -25 to +3 dBm.

3. Do no connect Tip or Ring to earth ground or short them together. (Oscilloscopes, signal analyzers, etc. should be isolated when monitoring signals on Tip or Ring.)

4. Do not connect unit to PBX or other telephone network outlets.

5. Do not leave the 5102 connected to unit under test when testing ESD susceptibility of other equipment such as modems, FAXes, etc.

6. The 5102 cannot have a load (600ohms) connected to both front and rear I/O telcos simultaneously.

CUSTOMER SERVICE INFORMATION

The Troubleshooting section of this manual, Section 10, was developed to specifically assist users of the PTT Model 5102 with any operational problem they might encounter. In addition, assistance for users is readily available from the Customer Service Manager and staff. Please feel free to write, call or FAX your questions or comments.

Customer Service Manager
Processing Telecom Technologies
901 Explorer Boulevard
Huntsville, Alabama 35806-2807
Telephone: 1-800-998-7880
FAX: (205) 971-8751

The PTT Telephone Network Simulator Model 5102 is under warranty for a period of two years according to the warranty statement in the Introduction Section of this manual. In resolving service problems, procedures outlined therein should be followed.

APPLICATION NOTE 5102-01

CONFIGURING THE MODEL 5102 FOR TYPICAL APPLICATIONS

During the initial sessions of setting up and becoming familiar with the general operation and control of the Model 5102, the following guidelines will be most helpful. Any variation used for setting up the simulator will result in the same operation.

Setup Procedure

Order of Select Buttons: The order in which the SELECT buttons are configured does not affect the final configuration achieved. The following order of procedure may be followed, or altered as desired.

Power ON: When turned on, (Power ON), the 5102 will return to the same state of configuration as when it was turned off, (Power OFF).

Save and Recall: Up to ten customized configurations can be "saved" in the 5102 for future reuse with the RECALL selection.

Suggested Setup for Modems

(Followed by Differences Encountered for Voice Only Signals)

With many different categories of modems available, it is difficult to provide a detailed setup procedure that works in all cases. For example, an autodial modem requires different CENTRAL OFFICE features than does a leased line modem. However, the sequence of the setup selections is quite similar. From the state of the 5102 at Power OFF, the steps might be:

Step 1: Power ON

When turning the power on for the 5102, notice that all the front panel LEDs and Displays are briefly activated, providing a visual check that the unit is functioning properly.

Step 2: Central Office Options

Press:	the CENTRAL OFFICE button
Use:	the SCROLL buttons to display Line Options
Press:	the CENTRAL OFFICE button to select
Use:	the SCROLL buttons to display one of the modes of operation Example: 2-Wire, if the modem requires this mode
Press:	the CENTRAL OFFICE button to select the displayed mode
Results:	The selected mode of operation is now resident in the simulator, and the 2-Wire submenus are presented for setting the loop currents for each network.

The Central Office parameters may be programmed by pressing the CENTRAL OFFICE button and selecting the SELECT CO submenu.

Step 3: PWR-OUT/ATTN

Determine the output power level desired at the output on Network B Interface. Alternatively, determine what attenuation is desired at 1004 Hz.

Under the heading "LEVEL"
Press: the PWR OUT or the ATTN button
Use: the SCROLL buttons to display the desired value
Press: the previously used select button to select the desired parameter

The output power cannot exceed the input power + 9.9 dBm. Consequently, if the output power is selected and subsequently a signal is applied with a lower input level on Network A Interface, the setting will change automatically when the input power is calibrated.

Determine the amount of noise desired for the test.

Step 4: NOISE

Press: the SETUP OPTIONS button
Use: the SCROLL buttons to display the desired choice between C-Message and Psophometric
Press: the SETUP OPTIONS button to select. Selections for C-Message or Psophometric include:

C-Message	Psophometric		
SNR 3KHZ	SNR 3KHZ	-	displays the Signal-to Noise ratio in dB.
SNR CMSG	SNR PSOP	-	displays the Signal-to Noise ratio in dB, weighted.
NOISE DBRNC	NOISE DBRNP	-	displays the Signal-to-Noise ratio in reference to -90 dBm.
NOISE DBMC	NOISE DBMP	-	displays absolute noise level in dBm, weighted.

Press: NOISE Button to set the amount of noise desired for the test
Use: the SCROLL buttons to display the desired Noise level
Press: the NOISE button to select the desired level

Step 5: Near End Echo

Determine the Near End Echo level desired for the test.

Press: the NEAR END ECHO button
Use: the SCROLL buttons to display the desired value
Press: the NEAR END ECHO button to select the desired value

Step 6: Line Type

Determine the Line Type desired for the test.

Press: the LINE TYPE SELECT button
Use: SCROLL buttons to display the desire type, e.g., 3002 B
Press: the LINE TYPE SELECT button to select the desired Line Type

If a signal has not been applied, the display will show, "PWR A <-25 DBM". Even so, the line type is still selected and set as directed.

Step 7: ATTENUATION (REVERSE)

Determine what ATTENUATION (REVERSE) is desired in the B to A Interface path.

Press: the ATTN (REV) button
Use: the SCROLL buttons to display the desired value
Press: the ATTN (REV) button to select the desired value

Note: this parameter shares the line type display during programming.

Step 8: AGC

Notice that the INPUT AGC LED is flashing. Establish a connection between the ports (by dialing, if this mode is chosen) and assure that power is being applied to the Network A Interface. To verify that the input signal is present, press the POWER MEASURE button.

Press: the AGC button
Use: the SCROLL button to display "signal cal"
Press: the AGC button
Results: the unit will go into a calibrating mode and configure the various internal parameters to achieve the specified values of SNR, and PWR-OUT (or ATTN 1004 Hz).

Step 9: Check Displays

Calibration is successful if a valid input signal is present and acceptable parameter values have been specified for this signal. For additional information, see Application Note 5102-03.

Check the PWR-OUT/ATTN (1004 Hz) and SNR displays to verify that they did not change from the selected value.

These parameters are mutually dependent on each other and on the Network A Interface input signal power. Consequently, the values selected may not be achievable for certain input power settings.

Example: Output power is not allowed to exceed input power + 9.9 dBm; and for very small output power, the highest SNR values are not allowed.

When the connection has been established and the AGC operation is successfully concluded, any of the preceding steps may be repeated to change any of the parameters. It is recommended that after making any

changes a recheck, using the AGC button, is made as a final step to verify the displays.

Step 10: SAVE

Any time a configuration is established, the option to save it is available. Ten address locations in the 5102 are identified for storing a setup for future reuse, or editing, without performing a complete reconfiguration.

Press: the SAVE button
Use: the SCROLL buttons to display the desired address
Press: the SAVE button to select an address from which the configuration can be recalled when next required for usage.

Completion:

After completing the preceding steps, the unit is ready for testing operations. The 5102 will remain in the present setup until the configuration is changed. Depending upon the particular test to be conducted, it may be necessary to hang up and redial or re-establish communications.

Additional changes to the PWR-OUT/ATTN (1004Hz) and the SNR may be made, or a call may be terminated and re-dialed (when Dial features are being used), and valid readings will be maintained provided that the input signal is not changed.

NOTE:

If the input signal is changed, in order to maintain correct readings on the SNR and PWR-OUT displays, it is necessary to perform one of two possible operations.

1) The SNR and PWR-OUT settings can be re-calibrated by selected and then deselecting the LINE TYPE, or by changing the LINE TYPE. This action will leave the AGC unchanged.
2) Press the AGC button to readjust the AGC setting and recalibrates the setting for PWR-OUT and SNR.

The preferred course of action depends on whether it is desired to maintain the exact same AGC setting.

Unique Characteristics for Voice Only Inputs

There may be many applications when it is desired to have telephones connected directly to the 5102 for voice communication. This is an available mode of operation.

The nature of the input signal is entirely different than cases when modem signals are applied. The primary difference is that the input power level is not constant. When the input power level is not constant it is not practical to set the signal-to-noise ratio. It is usually more important to control the attenuation at 1004 Hz for voice type applications.

It is still possible to add noise to the voice signal by using the NOISE select button. The noise mode may be set using the SETUP OPTIONS select button to set the noise to an absolute level as opposed to signal to noise ratio. Also, the SETUP OPTIONS button may be used to instruct the 5102 to assume a specific input signal level. In the case of voice, if the input signal level is not actually known, select PRESET INPUT mode and set the assumed input signal level to +3 dBm.

APPLICATION NOTE 5102-02

SNR CONVERSION

Some Useful Relationships:

SNR CMSG (dB) = SNR 3KHZ + 1.6 (dB)
SNR PSOP (dB) = SNR 3KHZ + 2.2 (dB)

Noise Conversions:

Conversions between dBm and dBrn (both measured in 300 to 3300 Hz bandwidth), dBm C-Message Weighted, dBrnC, dBm Psophometric Weighted, and dBrnp noise measurements are shown in the following table.

CONVERSION ⟶ *TO*

FROM ↓

	dBm 3KHz	dBm C-Msg	dBm 3KHz	dBrnC	dBm PSOP	dBrnp
	ADD					
dBm 3KHz	0	-1.6	+90	+88.4	-2.2	+87.8
dBm C-Msg	+1.6	0	+91.6	+90	-0.6	+89.4
dBm 3KHz	-90	-91.6	0	-1.6	-92.2	-2.2
dBrnC	-88.4	-90	+1.6	0	-90.6	+0.6
dBm PSOP	+2.2	+0.6	+92.2	+90.6	0	+90
dBrnp	-87.8	-89.4	+2.2	+0.6	-90	0

APPLICATION NOTE 5102-03

Purpose and Operation of AGC (Automatic Gain Control)

Role of the AGC

The basic objective of the AGC in the 5102 is to increase the useful input signal dynamic range. The AGC allows the application of input signals that may have considerably different power levels and still obtain optimum telephone line simulation in each case.

For the 5102 to achieve highly accurate simulations of telephone lines, digital signal processing techniques are used. This approach produces very nearly identical results every time a test is repeated on any of the 5102 units.

The digital signal processing method requires sampling the analog (continuously variable) signal that enters the unit and converting each sample to a numerical quantity (a "digital" value) for processing. To perform this conversion, an analog-to-digital (A/D) converter accepts a sample and produces a binary number with a fixed number of bits at its output. The output number is proportional to the voltage of the signal sample being applied to the A/D input. The voltage range which can be applied to the A/D input is limited. Similarly, only a limited set of binary numbers can be produced at the output, depending on the number of bits used.

AGC Operation

To operate correctly, the A/D converter should have only voltages applied at its input which do not exceed its input range. It is also desirable to scale the input signal so that the largest input signal peaks are only slightly below the maximum A/D input range. This utilizes as many of the available output binary numbers as possible. It is the purpose of the AGC to scale the input signal to achieve this goal. The AGC applies a gain (scale factor) to the input signal before it is sampled and sent to the A/D converter. By monitoring the input signal for a short time, the gain can be adjusted so that the peak variations of the input signal remain within the maximum allowable positive and negative inputs to the A/D converter (and are only slightly within these limits). Thus, the input signal does not overload the A/D converter and optimum usage is made of the input range.

Operation of the "Input AGC" Button

The need for an AGC circuit in a telephone line simulation has been established in the preceding information. It should be noted, however, that it is not desirable for the gain of the telephone line simulation equipment to change on its own during a test. The recommended way to operate an AGC circuit in such equipment is to properly set the gain at the start of a test and hold the gain constant, or "lock" the AGC for the duration of the test. The approach used for the 5102 is to lock the AGC at all times except when a specific command is given to set and relock the AGC. This is the purpose of the "INPUT AGC" button.

When the INPUT AGC button is activated (pressed), a submenu is shown on the Line Type display. Two types of AGC are available. The first and most common is the Signal Cal. This is equivalent to the remote command "AGC". When "signal cal" is selected, the 5102 first measures the input power to determine if it is within the proper operating range. While the input power is being measured, the INPUT AGC button will flash and the line type display flashes the message "CALIBRATING", indicating that the calibrations measurements are being made.

If the input power is within range when the INPUT AGC button is pushed the second time, the AGC circuit will adjust the 5102 gains to the optimum values for processing the signal. When the proper setting of the gains have been completed, the INPUT AGC button will stop flashing and remain constantly ON, indicating that a valid AGC setting has been found and the AGC has been locked at the proper gain values.

The second type of AGC is provided only for the bidirectional test system. This method provides a 1004 Hz sinusoid to the input of each PTT 5151 such that the forward and reverse path impairments are calibrated. The INPUT AGC submenu also contains the selection 1004 Hz CAL. Selecting this item will initiate the system calibration using the 1004 Hz tone. This same function can be accomplished remotely with the following commands:

PRESETA[,X1]	set amplitude of 1004 Hz tone for forward calibration.
PRESETB[,X1]	set amplitude of 1004 Hz tone for reverse calibration.
TCAL	generates tones and sends AGC command to 5151's.

Setting the AGC Gain Values

The AGC gain values can be set in only four ways. Unless the AGC is operated in one of these four methods, the gains will not change.

1) pressing the INPUT AGC button as previously described
2) performing a RECALL (where the AGC gain is restored to the value previously in use when the corresponding SAVE command was issued)
3) turning on the power switch (where the AGC gain is restored to the value it had when the power was turned off)
4) setting the unit for a fixed input level via the SETUP OPTIONS button, and the Preset Input selection.

Note: the input power is NOT continuously monitored and used to adjust the AGC.

The POWER MEASURE button provides a method to monitor or manually adjust the input power. The input power may be checked at any time to verify the setting.

The INPUT AGC Status Indicator

The LED in the center of the INPUT AGC button indicates three different conditions; flashing, constantly ON, constantly OFF.

LED Flashing: either no valid AGC setting has been obtained since the power was turned on, or the most recent attempt to adjust the AGC failed to produce a valid AGC setting.

Normally a flashing LED on the INPUT AGC button indicates that the button should be pressed before a test is conducted. There are exceptions. For example, when power is first turned on, the AGC setting is restored as it was when power was turned off. The LED is flashing to warn that the AGC has not been set since power was activated. If the same input signal is to be applied as before turning off the power, the testing may proceed without adjustment.

It is recommended that for normal use a readjustment be effected unless it is determined that a system identical to the configuration in use when power was terminated (including exactly the same AGC setting) and it is verified that the input is the same. An input power measurement may be obtained for verification by using the POWER MEASURE button.

LED Constantly OFF: follows a RECALL operation.

The AGC gain is restored to exactly the value present when the SAVE command was issued to store the system configuration. The LED is OFF to indicate that the state of the 5102 has been restored exactly as it was saved even though no AGC adjustment based on a new measurement has occurred. Testing may proceed without further adjustment.

Note: if the input signal has changed from that in use when the configuration was saved, incorrect test results will be obtained. An input power measurement may be obtained for verification by using the POWER MEASURE button. Unless it is specifically desired that the AGC not readjust, it is recommended that the INPUT AGC button be pressed, and Signal CAL selected, to ensure a valid AGC setting.

LED Constantly ON: indicates the button has been pushed and the AGC adjustment reached a valid gain setting and has locked at that point. This is normally the desired status for performing telephone line simulation.

AGC Operation for Valid SNR and Power Output Displays

Related to the operation of the INPUT AGC button is how the 5102 sets the power output (if selected) and how it sets the SNR to the value requested.

The signal power output is measured internally during certain operations. This measurement is then used to set the power output (if selected); it is also used to determine the noise level needed to produce the SNR setting requested.

The power output is measured during only two operations:

1) upon pressing the INPUT AGC button
2) upon selecting a line type

Note: *Output power is not constantly monitored. It must be verified that the Input has not been changed following a use of the "Input AGC" or selection of the line type. If input has changed and neither of these operations has been subsequently performed, the power out value displayed and the SNR value displayed generally will not be valid.*

If it is desired to re-calibrate the power output and the SNR without readjusting the AGC, the same line type that is already in use may be re-selected.

Verification of Setting

It is vital to assure that the input has not changed since the power output was internally calibrated. Verification can be effected by pressing the INPUT AGC button and selecting Signal Cal just before a test (or re-select the line type if it is not desired to make the AGC change). To verify the input power without readjusting the system, press the POWER MEASURE button.

The recommended procedure is to activate the Signal CAL AGC at the start of a test and at any time the power input may change, such as when the input signal source (a reference modem, for example) is changed.

Alternate Simulation Approaches

An alternative simulation approach is one of constantly monitoring output power and continuously adjusting gains through the system. This is not desirable since it removes the custom-use control capabilities. Using the simulator in this fashion would produce an unrealistic telephone line simulation, as the line would be constantly subject to variations in response to the input. This is not in keeping with an actual telephone line.

The **recommended procedure** for the 5102 AGC affords full control in setting the simulation and ensures that the system will remain exactly as is set throughout all testing. This procedure does require monitoring changes of the input and providing AGC readjustment (or re-selecting the line type) in order to avoid invalid displays for power output and SNR.

An alternative to using the INPUT AGC function is to set the 5102 at the input level to assume the PORT A input (Preset Input Function). The 5102 will then set the input gain amplifier to the optimum setting corresponding to the designated input signal size. To ensure the output power level and signal-to-noise ratio are accurate, the LINE TYPE should be selected and deselected. It is also necessary to verify the 5102 has been commanded to assume an accurate input signal level. This provides a mechanism to guarantee the input gain setting is exactly the same from test to test.

APPLICATION NOTE 5102-04

PTT 5102 TELEPHONE NETWORK SIMULATOR

USING PTT EQUIPMENT TO ADDRESS THE REQUIREMENTS OF EIA/TIA TELECOMMUNICATIONS SYSTEMS BULLETIN 37

The purpose of this application note is to inform the modem tester about evolving modem testing standards in general, with a special emphasis on modem testing as it relates to EIA/TIA TELECOMMUNICATIONS SYSTEM BULLETIN 37. A TSB 37 ModemTest Station utilizing PTT test equipment is described with the PTT TSB 37 Test Library provided with EZBERT 6.0, PTT's remote control software package. All of the equipment identifed in this test station can be purchased from PTT by ordering the following two line items.

Model	Description
MTS-BI	Bidirectional System
5200 LL-2	Two Local Loop System

BACKGROUND INFORMATION

High speed modems operating full duplex over the dial up telephone network are a reality. As modems have evolved from the days when 1200 bps was fast, so have the networks evolved. Just as the modem, the network has grown in complexity. Within the industry this leads to greater emphasis on testing to ensure that these sophisticated modems will operate properly in all circumstances regardless of the impairments presented by the network.

Evolving Standards

Standards exist for current modem technology: V.22, V.32, V.32 bis and V.42, to name a few. New standards are emerging, such as V.FAST, which provide uncompressed bit rates in excess of 20,000 bps over the dialup network. Similarly, standards are now in existence and others evolving, which define the telephone network over which the modem will ultimately operate. The older standards, such as EIA-496A which considered only the US network were good, however, new and more up-to-date standards were needed that addressed not only the US network, but also included information on transcontinental links and international networks. These new rapidly emerging standards will provide a common basis for modem manufacturers, users and third-party testing laboratories to test for comparison of modem performance.

The TSB 37 is one standard released by the EIA in February of 1992. This standard describes a network transmission simulator for use in testing modems intended for use in the U.S. Public Switched Telephone Network (PSTN). This bulletin extends the scope of EIA/TIA 496A, Section 5, to include additional test channels designed with the explicit purpose of testing the modem's ability to cancel echoes. The simulator architecture was also

expanded to include full duplex impairments. To simulate realistic echo conditions resulting from the varying impedances of different subscriber local loops, the TSB 37 specifies a loop at the modem-under-test end (Modem B). At the reference end (Modem A), a simple impedance isolation pad with a fixed loss is specified. Similar standards are emerging for Europe. The solutions described in the note should be generally applicable to the new European standards.

THE PTT SOLUTION

PTT provides a complete range of standard products, that can be configured per the standards previously mentioned, to form a complete test station for high speed modems. The modular instrument approach of the PTT products promotes efficient implementation from only limited portions of the network simulator to a complete comprehensive test station.

Network Simulation Equipment

The PTT 5102 and PTT 5151A with option card, can be programmed to emulate virtually any telephone network, worldwide, including US, CCITT, and Japanese standards. The PTT 5102 provides the basic network interface operations including telephone network Hybrids, DTMF and Pulse dial decoding, and other related Central Office functions. The PTT 5151A Echo/ Advanced Impairments Simulator equipped with an Option Card provides all of the additional impairments necessary to implement the Network Simulator. Two PTT 5151As are used to simulate full bidirectional impairments for applications which include testing full duplex echo canceling equipment such as V.32 bis modems.

The PTT 5200 Cable Simulator and PTT 5210 Local Loop Adaptor provide the subscriber Local Loop portion of the network simulation. The PTT 5200 provides up to four local loops. The PTT 5210 provides the interconnection circuitry necessary to connect the loops to the Central Office simulator. The Local Loop is attached between the Modems and the Central Office simulator to accurately simulate the effects of varying cable impedance and amplitude shaping. This is extremely important when testing echo canceling modems. The impedance mismatches, caused by the addition of local loops, can increase the amount of Near and Far end echo levels present at the modems which can seriously affect performance.

There are two loops used on the Modem B side of the Network Simulator, (see Figure 1). One local loop simulator connects the Modem and the Central Office Simulator. The second loop, referred to as a matching loop, is connected to the Central Office Hybrid (2 wire to 4 wire convertor) and is used to balance the Hybrid. This balancing technique insures that the hybrid inside the PTT 5102 is balanced as nearly perfect as possible and does not add any additional "uncontrolled" echoes. For TSB 37, a simple "attenuator pad" is used on the Modem A side which is manually selectable from the PTT 5210. If desired, the pad and balancing resistor on the Modem A side could be replaced by a standard local loop with matching balancing loop.

The PTT 5721 PCM/ADPCM simulator provides optional impairments to simulate the effects of digitization in the network. When the Modem signal is converted to a digital signal in the network using PCM techniques, an additional amount of noise is added to the signal. This additional noise, usually referred to as quantitizing noise, may affect the performance of higher speed modems. In certain connections, particularly transcontinental, digital ADPCM techniques may be used for speech compression. This usually results in poorer performance as it adds an additional amount of noise and Intermodulation Distortion to the modem signal.

Data Analyzer

The PTT 5000 data communications link analyzer and the PTT 5232 Digital Switch send data to each of the Modems and they also monitor the results to determine if there were errors in the data received. The attached Personal Computer is capable of reading and storing the resulting errored data for the PTT 5000. As information stored in the PC, performance data, such as Bit Error Ratio (BER), Block Error Ratio (BLER), or other similar statistics, can be computed.

EZBERT PC Software: Linking the Elements

The PTT EZBERT software can be used to completely automate the equipment configuration, data gathering and data analysis process. Configuration files are available in the EZBERT library to quickly and easily configure the equipment according to the eight impairment combination lines listed in TSB 37. Once the equipment has been configured using EZBERT, simple test scripts can automatically configure the Modems, establish a dial-up connection and collect data for analysis. Utilities are available for data viewing, printing and plotting .

UNDERSTANDING THE CAPABILITIES OF THE MODEM TEST STATION

Control Options

The following TSB 37 Modem Test Station is fully bidirectional. This means that all impairments are available in both directions (A to B, and B to A). The TSB 37's block diagram of the network simulator is not completely bidirectional, as it has replaced the local loop simulator on side A with an attenuation pad. The fully bidirectional Modem Test Station, identified herein, places either local loop simulation or an attenuation pad on side A. Switching between these two choices can be accomplished by operation of a push button on the rear panel of the PTT 5210 Local Loop Adaptor.

Prior to setting up the TSB 37 Bidirectional Modem Test Station of Figure 1, verify that all of the equipment and interconnecting cables have been included. A full understanding of the purpose and use of each piece of equipment is important and will greatly assist in the actual setup. For a better understanding of the equipment, it is recommended that the user manual associated with each product be studied prior to beginning the setup procedures.

A WORD OF CAUTION ABOUT TELCO CABLES

Cable Restrictions

Two types of telco cables are provided with the PTT equipment:

1) RJ45 reverse telco cables (stamped "Reverse")
2) RJ11 straight telco cables

It is very important to use only the telco cables supplied by PTT, as the telco jacks on all PTT equipment have been designed to work with these cables. Use of telco cables, other than those provided by PTT is not recommended.

SETTING UP THE MODEM TEST STATION

The steps for the setup of the TSB 37 Bidirectional Modem Test Station should be followed in the order given. A brief description of each piece of equipment is included to assist in providing an understanding of its function. Following the description is a setup section describing which cables are to be connected to the equipment. Refer to Figure 1 for visual assistance with each step.

THE PTT 5210 LOCAL LOOP ADAPTER

The PTT 5210 provides easy access to four local loops located in the PTT 5200. Local loop simulation is provided between the NI (Network Interface) and the EO (End Office Interface) of each local loop grouping. (See Figure 6.) Local Loop 3 has a optional 6.1 dB attenuation pad (as identified in the TSB 37) which can be used instead of the local loop. A push button located on the rear panel of the PTT 5210 selects either local loop card #3 or the 6.1 dB attenuation pad. All the connections identified on the front panel using RJ11 telco jacks are also available on the rear panel as screw terminals. The T and R labels on the rear panel represent Tip and Ring, which are the middle two conductors, 3 and 4 (red and green), of a RJ11 modular connector.

Connection

Step 1 Connect the PTT 5210 to the PTT 5200 User Node Routing Port with a 64 pin ribbon cable. This cable is provided as a permanent attachment to the PTT 5210; removal should not be attempted.

Step 2 Connect Modem A to the PTT 5210 Local Loop 3 NI port with a RJ11 straight telco cable.

Step 3 Connect the PTT 5210 Local Loop 3 EO port to the PTT 5102 2-Wire A port with a RJ11 straight telco cable.

Step 4 Connect the PTT 5210 Local Loop 4 EO port to the Balance A port of the PTT 5102 rear panel with a RJ11 straight telco cable.

Step 5 Terminate the PTT 5210 Local Loop 4 NI port on the rear of the PTT 5210 by connecting a 604 ohm resistor between the T and R connection points, (or by connecting a modem to Loop 4 NI port on the front of the 5210 using a RJ11 straight telco cable).

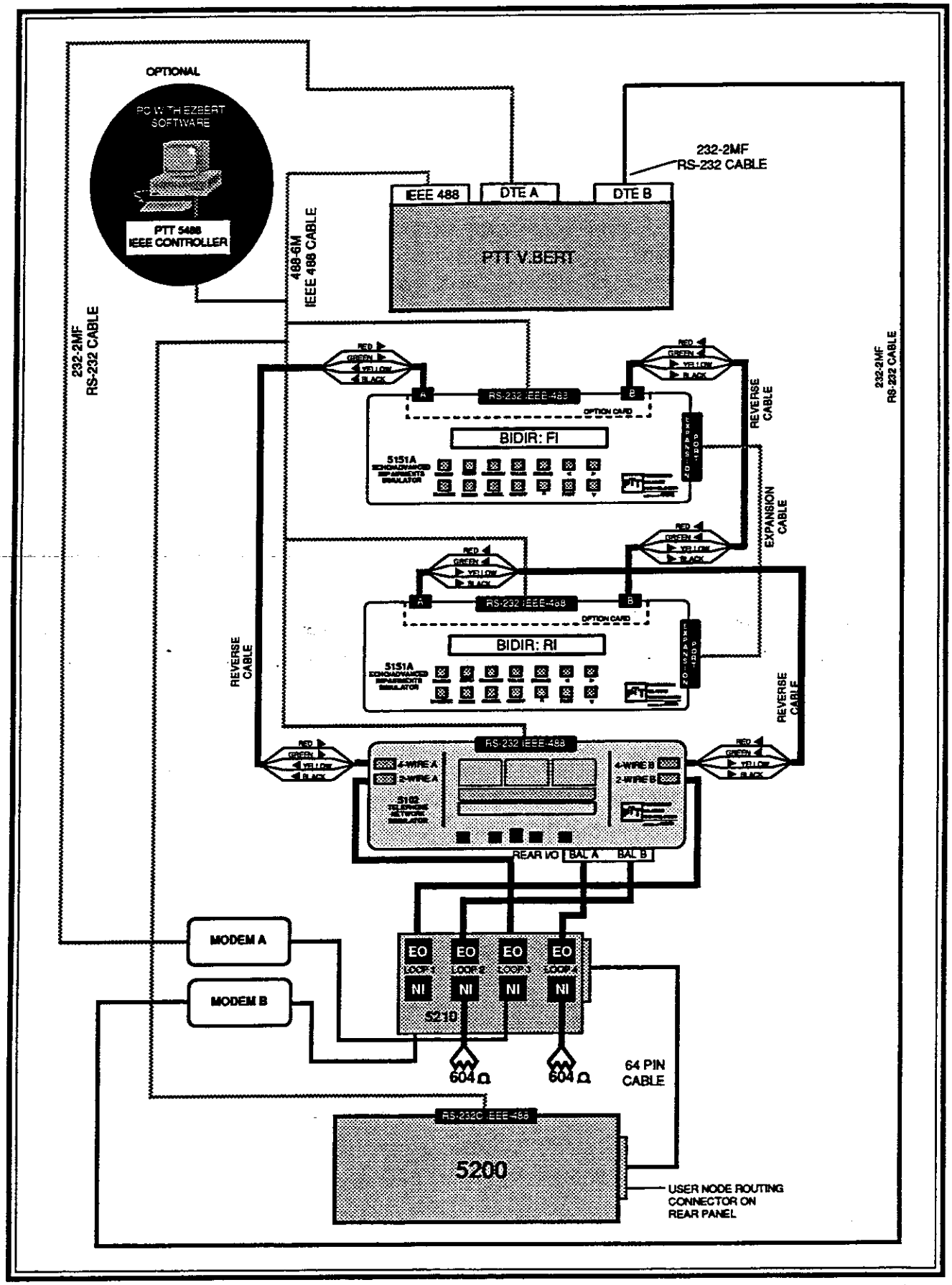
Step 6 Connect Modem B to the PTT 5210's Local Loop 1 NI port with a RJ11 straight telco cable.

Step 7 Connect the PTT 5210 Local Loop 1 EO port to the PTT 5102 2-Wire B port with a RJ11 straight telco cable.

Step 8 Connect the PTT 5210 Local Loop 2 EO port to the Balance B port of the PTT 5102 rear panel with a RJ11 straight telco cable.

Step 9 Terminate the PTT 5210 Local Loop 2 NI port on the rear of the PTT 5210 by connecting a 604 ohm resistor between the T and R connection points,

FIGURE 04-1: BIDIRECTIONAL MODEM TEST STATION



(or by connecting a modem to Loop 2 NI port on the front of the 5210 using a RJ11 straight telco cable).

THE PTT 5200 ISDN/DDS CABLE SIMULATOR

This unit contains the local loop simulators (up to a maximum of four) required by the TSB 37 for simulation and balancing. The PTT 5200 has a 64 pin User Node Routing port on the rear panel which provides easy access to the User Node Routing points.

Connection

Connect the PTT 5200's IEEE-488 control port to the PTT 5488 with an IEEE-488 cable.

THE PTT 5000 MODEM TEST

This unit is a Bit Error Rate Tester (BERT). It analyzes modem performance by transmitting a testing pattern from one modem (Reference Modem) through the impaired network to the other modem (Modem Under Test).

Connection

Step 1 Connect the PTT 5000 IEEE-488 port to the PTT 5488 IEEE-488 port with an IEEE-488 flat ribbon cable.

Step 2 Connect the PTT 5000 DCE port to the PTT 5232 DTE port with a RS-232 cable.

Step 3 Connect the PTT 5000 external power connector to the PTT 5232 external power connector with a special five-pin to three-pin power cable (provided).

THE PTT 5232 RS232 DIGITAL SWITCH

This unit permits the PTT 5000 to perform BERT tests in either direction (Side A to Side B, or Side B to Side A).

Connection

Step 1 Connect the Modem A RS-232 port to the Modem A port of the PTT 5232 with a RS-232 cable.

Step 2 Connect the Modem B RS-232 port to the Modem B port of the PTT 5232 with a RS-232 cable.

Step 3 Connect the PTT 5232 IEEE-488 port to the PTT 5488 IEEE-488 port with an IEEE-488 flat ribbon cable.

THE PTT 5102 TELEPHONE NETWORK SIMULATOR

This unit provides Central Office features to modems on both sides (A and B) of the test station and provides the two wire to four wire conversion at the 4-Wire A and the 4-Wire B ports.

Connection

Step 1 Connect a RJ45 reverse telco cable between the 4-Wire A port on the front panel of the PTT 5102 to the 4-Wire A port on the back panel of the "forward path" PTT 5151A.

Step 2 Connect a RJ45 reverse telco cable between the 4-Wire B port on the front panel of the PTT 5102 to the 4-Wire A port on the back panel of the "reverse path" 5151A.

THE PTT 5721 PCM/ADPCM LINK SIMULATOR

This unit is capable of simulating two digital (PCM/ADPCM) links and could be added to the Modem Test Station, as shown in Figure 04-1.

Connection Consult the PTT 5721 User Manual.

THE PTT 5151 ECHO/ADVANCED IMPAIRMENTS SIMULATOR (FORWARD PATH, OR A —≥BDIRECTION)

This PTT 5151 should be placed in the forward impairments (BIDIR: FI) mode to provide full trunk impairments from Side A to Side B. When placed in this mode, this unit will provide impairments in the "forward path".

Connection

Step 1 Connect a RJ45 reverse telco cable from the "forward path" PTT 5151A's 4-Wire B port located on its rear panel to the "reverse path" PTT 5151A's 4-Wire B port located on its rear panel.

Step 2 Connect the 40 pin flat interface cable between the expansion port of the "forward path" PTT 5151A and the expansion port of the "reverse path" PTT 5151A.

THE PTT 5151A ECHO/ADVANCED IMPAIRMENTS SIMULATOR (REVERSE PATH, OR B —>A DIRECTION)

This PTT 5151A should be placed in the reverse impairments (BIDIR: RI) mode to provide full trunk impairments from Side B to Side A. When placed in this mode, this unit will provide impairments in the "reverse path".

Connection All interconnections to this unit should have been completed in previous steps.

THE PTT 5488 IEEE CONTROLLER (IOTECH 488)

This unit provides IEEE-488 control of all test equipment in the Test Station. One side of the unit connects to the PC via a straight RS-232 cable. The other side connects to an IEEE-488 cabling system that connects all of the test equipment.

Connection

Step 1 Connect a RS-232 cable from the RS-232 port of the PTT 5488 to the COM 1 or COM 2 port on the PC.

Step 2 Several pieces of equipment will be connected to the IEEE-488 control port of the PTT 5488 as described in previous and following steps. The IEEE-488 cables (supplied) will accommodate the connections required for an IEEE-488 bus system with one master and several slaves.

THE PERSONAL COMPUTER

PTT EZBERT remote control software can be run on the PC to provide full automated control of the Test Station.

Connection All interconnections to the PC should have been completed in previous steps.

EZBERT MODEM TEST SOFTWARE

The PTT EZBERT 6.0 software package was designed to support automated equipment configuration and BERT testing with PTT equipment. This software will only run on and IBM XT, AT, or 100% compatible computers using DOS 3.0 or higher with 640K memory. Included with EZBERT 6.0 is a complete library for testing EIA/TIA Lines 1 through 16 as identified in EIA 496A and TSB 37. Provision of this outstanding library greatly simplifies the test process. The use of the EZBERT 6.0 software package is covered in the section "Automated Operation of the Test Station Using EZBERT Remote Control Software" of this publication.

VERIFYING THE INTEGRITY OF THE TEST STATION'S SIGNAL PATH

PTT recommends performing a signal path check before proceeding. The simplest method of verifying the signal path is to replace the two modems of the Test Station with two standard telephones and perform the following steps:

Step 1 Power up the entire Test Station, or power up the individual pieces of equipment, one at a time.

Step 2 Set the "forward path" PTT 5151A to BIDIR: FI mode. Set the "reverse path" PTT 5151A to BIDIR RI mode.

Step 3 Set the "forward path" PTT 5151A 1004 attenuation level to:
ATTN (1004Hz) =+00.0dB.

Set the "reverse path" PTT 5151A 1004 attenuation level to:
ATTN (1004Hz) =+00.0dB.

Step 4 Enable Central Office features with 25 MA of loop current on both the A and B sides of the PTT 5102.

Step 5 Pick up the A side telephone and dial 2 to ring the B side telephone. After the B side telephone starts ringing, take its receiver off hook. Verify that there is a bidirectional voice connection for side A through to side B and from side B through to side A. An easy way to check this would be to generate a DTMF tone on side A and and listen for it on side B. Repeat the process in reverse by generating a DTMF tone on side B and listen for it on side A.

Step 6 If a bidirectional voice connection was not achieved in the previous step, check the presence of the signal at various points to isolate the fault.

Performing a power measure on the A or B sides of the PTT 5102 while generating a DTMF signal with either of the telephones will provide a quick determination of whether the DTMF signal is getting through the PTT 5210 and PTT 5200 to the PTT 5102.

Performing a power measure on the "forward path" or "reverse path" PTT 5151A will provide a quick determination of whether the DTMF signal is getting through the PTT 5210, PTT 5200 and PTT 5201 to the PTT 5151A.

Both PTT 5151As can be placed in "back-to-back" mode, which provides a metallic path connection through the units. This is very useful for verifying that cables are properly connected.

Connections to the 4-Wire ports of the PTT 5102 could be removed and a single reverse telco cable can be connected from 4-Wire A to 4-Wire B to totally bypass both PTT 5151s.

AUTOMATED OPERATION OF THE TEST STATION USING EZBERT REMOTE CONTROL SOFTWARE

EZBERT software provides the capability of running existing library test files or create new tests through the menu driven interface. Immediately after EZBERT has been installed and executed, the first step is to manually setup the equipment.

Step 1 From the EZBERT MAIN MENU, select: A. EQUIPMENT

Step 2 Select: D. BIDIRECTIONAL: 1 PTT 5000

Step 3 Select "yes" for the equipment present and select IEEE 488 addresses for the PTT 5102 (5101), 5151A FWD, 5151AREV, 5232, and 5000, as defined below.

Step 4 Use Function Key F2 to configure the 488 controller as either internal or external.

Step 5 The PTT 5200 does not have a setting on this screen. The PTT 5200 will be directly addressed in the "MODEM CONTROL (& OTHER)" submenu. The format will be SRQ09 for device which means that the PTT 5200 is a SRQ 488 device at address 9. To reach this submenu:
Select: B. CONFIGURATION from the EZBERT Main Menu.

SETUP OF EQUIPMENT FOR REMOTE CONTROL

Now that the EZBERT has been set to recognize for the IEEE-488 addresses, the next step is to manually set the IEE-488 address on each piece of equipment. The EZBERT manual contains details of how to set the addresses for all of the following equipment except for the PTT 5200. See Appendix B in the EZBERT manual and Section 3 - General Setup Options in the PTT 5200 manual.

PTT 5200 Setup Set the 488 address to 9 (default).

PTT 5000 Setup Set the 488 address to 3 (default).
Select 488 control (default).
Select CRLF line terminator (default).

PTT 5232 Setup Set the 488 address to 2 (default).

PTT 5102 Setup Set the 488 address to 4 (default).
Select 2WBIDIRECT.
Set loop current to 25 mA for Port A and Port B.
Enable Central Office features.
Select FRONT I/O.

PTT 5151 FWD Setup Select the BIDIR:FI mode.
Set the 488 address to 5.

PTT 5151 REV Setup

Select the BIDIR:FI mode.
Set the 488 address to 7.

VERIFY 488 BUS

Now that the equipment and EZBERT are set to the proper addresses, the 488 integrity should be verified. From the EZBERT MAIN MENU: Select: [H. DIRECT COMMAND MODE]. The following list of commands (Figure 2) should be sent, using the <F3> key, and responses verified.

FIGURE 04-2: VERIFY REMOTE CONTROL ADDRESSES

EQUIPMENT	COMMAND	RESPONSE
PTT 5102	LINE	"2WBIDIRECT"
PTT 5151 FWD	51MODE	"5"
PTT 5151 REV	51MODE	"6"
PTT 5232	MODE	"A>B"
PTT 5200	VERSION	SOFTWARE REVISION
PTT 5000	VER	SOFTWARE REVISION

If a unit dies not respond to remote commands, verify the EZBERT 488 address for that unit, the unit's 488 address, and check the IEEE-488 cable connections.

LIBRARY FILES

A set of library files is included with EZBERT 6.0 which have all of the EIA lines defined. The Syntax, structure, etc. are as follows:

.cfg - configuration files
.tst - test files
##xy@$$m.cfg
- EIA LINE
x - L for local loop A
- P for 6.1 dB pad for loop A
- _ for no pad or local loop A
y - L for local loop B
- P for 6.1 dB pad for loop B
- _ for no pad or local loop B
@ - B for bidirectional
$$ - country
m - mode A for asynchronous
mode S for synchronous

Example:

07PLBUSA.CFG
07 - eia line 7
P - 6.1 dB pad for local loop A
L - local loop for local loop B
B - bidirectional
UA - USA Central Office features
A - async test

EZBERT CONFIGURATION SCREENS VS. TSB 37

To access the CONFIGURATION SUBMENU, from the EZBERT MAIN MENU:

Select: [B. CONFIGURATION] . From this submenu, files can be created for configuring the Bidirectional Modem Test Station. There are a few basic settings that will be common to any bidirectional test. They are:

FIGURE 04-3: BASIC BIDIRECTIONAL SETTINGS

MENU SELECTION	OPTION	SETTING
5102 / Additional	Telco Jack Option	2W Bidirect
5102 / Additional	I/O Mode	Fron
5102 / Option Card (Forward)	Operation Mode	Bidirectional Forward
5102 / Option Card (Reverse)	Operation Mode	Bidirectional Reverse

NOTE: *LINETYPE, NOISE, POWER OUT, AND 1004 Hz ATTENUATION selections under the '5102 / ADDITIONAL' submenus have no affect if 2W Bidirect is selected. These parameters should be set from the '5151A / OPTION CARD' screen.*

TERMINOLOGY

The TSB 37 and PTT terminology is not always the same. The table in Figure 4 explains terminology and which EZBERT screen contains the parameter in question.

FIGURE 04-4: NETWORK (EO TO EO) PARAMETERS

TSB 37		UNITS	EZBERT Screen and Parameter
1a. Attenuation Distortion 1b. 2804 Hz Slope 2. Envelope Delay Distortion			1a and 2 are set by Echo Distortion on 'PTT 5151/ECHO AND DELAY' screen. 1b is set by selecting 1a and 2. See Figure 04-5
3. 1004 Hz loss		dB	1004 Hz attenuation on 'PTT 5151/OPTION CARD' screen
4. 1004 Hz Signal Level to 3 kHZ Noise Ratio	(A>B) (B>A)	dB dB	SNR 3kHz on 'PTT 5151/OPTION CARD' screen
5. Phase Jitter (peak-peak)	(A>B) (B>A)	Deg. Hz Deg. Hz	PHASE JITTER on 'PTT 5151/ADDITIONAL' screen
6. Intermodulation Distortion	(R2) (R3)	dB dB	2nd ORDER NONLINEAR DISTORTION 3rd ORDER NONLINEAR DISTORTION on 'PTT 5151 ADDITIONAL' screen
7. Frequency Offset	(A>B) (B>A)	Hz Hz	FREQUENCY OFFSET on 'PTT 5151/ ADDITIONAL' screen
8. Propagation Delay	(A>B) (B>A)	ms ms	SATELLITE DELAY on 'PTT 5151/ECHO AND DELAY' screen
9. Far-End Echo Attenuation	(FEA-A) (FEA-B)	dB dB	FAR END ECHO on 'PTT 5151/ECHO AND DELAY' FORWARD acreen FAR END ECHO on 'PTT 5151/ECHO AND DELAY' REVERSE screen
10. Impulse Noise (A to B Only)		dBmc	IMPULSE NOISE on 'PTT 5151/ ADDITIONAL' screen

Local Loop Parameters

11a. Local Loop Type (A) 11b. Attenuator Loss	 dB	6.1 dB pad set with push button on PTT 5120
12a. Local Loop Type (B) 12b. Local Loop Loss at 1004 HZ 12c. 2804 Hz Slope	 dB dB	Local Loop selected in 'MODEM CONTROL (& OTHER)' screen with direct commands to PTT 5200. 12b and 12c are selected by selecting 12a

A > B 5151 FWD EXCEPT WHERE NOTED
B > A 5151 REV EXCEPT WHERE NOTED

DEFINITION OF PTT LINETYPES

Figure 5 describes the definition of PTT LINETYPES related to EIA 496-A and the TSB 37

FIGURE 04-5: ATTENUATION/DELAY DISTORTION TO PTT LINETYPES

ATTENUATION DISTORTION	ENVELOPE DELAY DISTORTION	PTT 5101, 5102, 5151 EZBERT SETTING
EIA A	EIA 1	TR30 .3-1
EIA C	EIA 2	TR30 .3-2
EIA B	EIA 3	TR30 .3-3
EIA B	EIA 4	TR30 .3-4
EIA B	EIA 5	TR30 .3-5
EIA B	EIA 2	TR30 .3-6

TSB 37 CROSS REFERENCE TABLE	
TSB 37 Line	5102 Line Type Selection
7	TR30.3-1
8	TR30.3-6
9	TR30.3-6
10	TR30.3-1
11	TR30.3-1
12	TR30.3-4
13	TR30.3-3
14	TR30.3-6
15	TR30.3-1
16	TR30.3-1

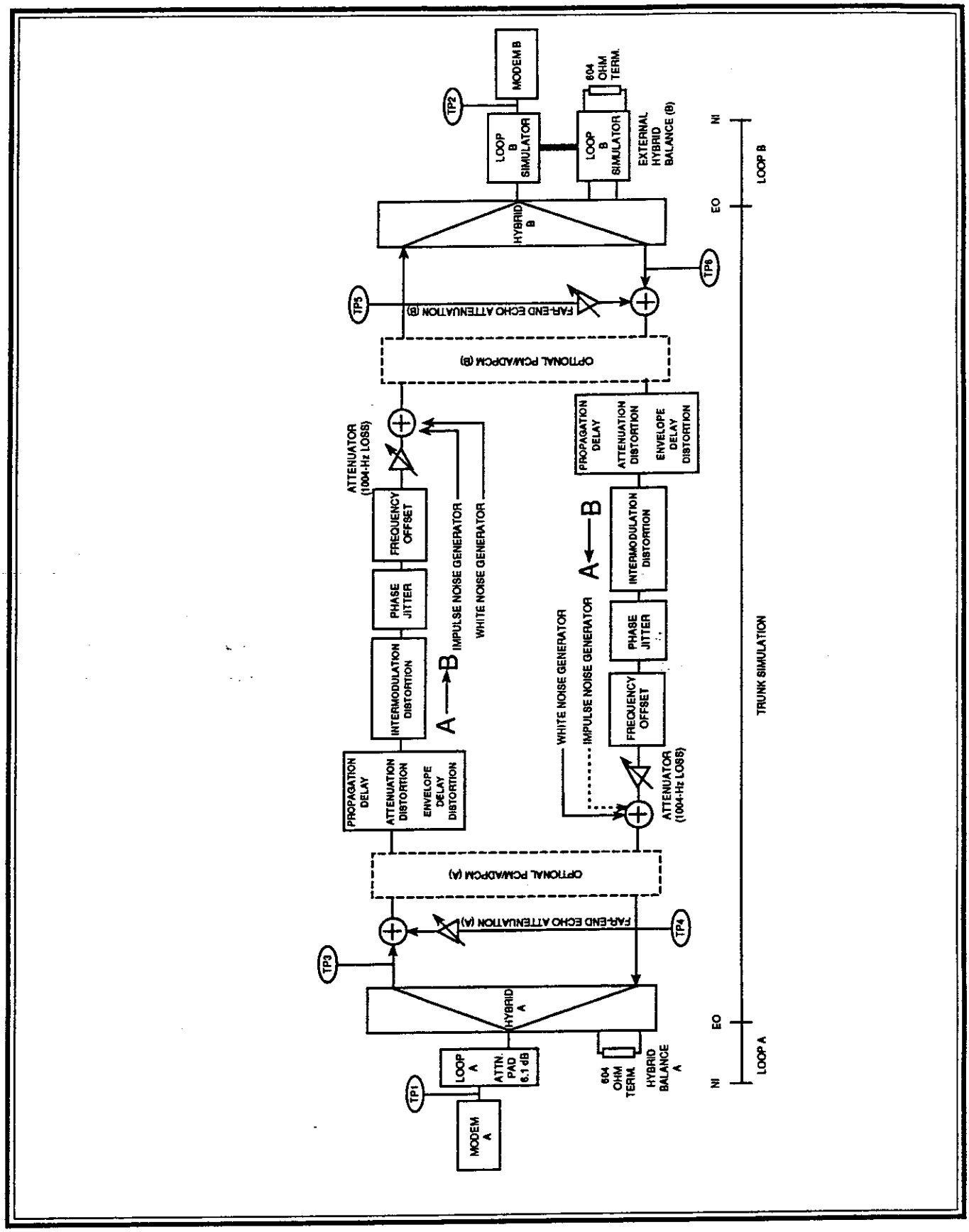
Figure 04-6 displays the impairment settings as defined in TSB 37.

Figure 04-7 displays the signal flow as defined in TSB 37.

FIGURE 04-6: IMPAIRMENT COMBINATION TABLE

Types of Impairments		Units	Line 7	Line 8	Line 9	Line 10	Line 11	Line 12	Line 13	Line 14	Line 15	Line 16
Network (EO to EO) Parameters												
1a. Attenuation Distortion		-	EIA A	EIA B	EIA B	EIA A	EIA A	EIA B	EIA B	EIA B	EIA A	EIA A
1b. 2004 Hz Slope		dB	1.2	5.5	5.5	1.2	1.2	5.5	5.5	5.5	1.2	1.2
2. Envelope Delay Distortion		-	EIA 1	EIA 2	EIA 2	EIA 1	EIA 1	EIA 4	EIA 3	EIA 2	EIA 1	EIA 1
3. 1004 Hz Loss		dB	8	3	15	6	6	3	3	3	6	8
4. 1004 Hz Signal Level to 3kHz Noise Ratio	(A-> B	dB	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	Variable	33
	(B-> A)	dB	33	33	33	33	33	33	33	33	33	33
5a. Phase Jitter (peak-peak)	(A-> B)	Deg.	10	4	4	7	0	4	4	4	0	0
		Hz	20	60	120	60	0	60	60	60	0	0
5b. Phase Jitter (peak-peak)	(B-> A)	Deg.	10	4	4	7	0	4	4	4	0	0
		Hz	21	61	121	61	0	61	61	61	0	0
6. Intermodulation Distortion	(R2)	dB	42	42	45	53	42	47	53	42	42	53
	(R3)	dB	40	40	43	53	40	45	53	40	40	53
7. Frequency Offset	(A-> B)	Hz	0	0	-1	1	0	2	0	0	0	0
		Hz	0	0	0.5	-1	0	-1	0	0	0	0
8. Propagation Delay	(A-> B)	ms	25	25	350	50	70	25	50	25	70	25
	(B-> A)	ms	25	25	350	50	70	25	50	25	70	25
9. Far-End Echo Attenuation	(FEA-A)	dB	14	17	7	5	5	7	7	17	5	14
	(FEA-B)	dB	14	17	7	10	14	18	18	17	14	18
10. Impulse Noise (A to B only)		dBmc	-	-	-	-	-	-	-	-	-	Variable
Local Loop Parameters												
11. Local Loop Type (A)		-	Pad	Pad	Pad	Pad	Pad	Pad	Pad	Pad	Pad	Pad
11b. Attenuator Loss		dB	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
12a. Local Loop Type (B)		-	#1	#4	#2	#1	#3	#5	#5	#6	#7	#2
12b. Local Loss at 1004 Hz		dB	1.1	6.1	3.2	1.1	3.8	7	7	6.6	5.9	3.2
12c. 2804 Hz Slope		dB	0.2	3.5	1.3	0.2	1.8	4.8	4.8	3.4	1.1	1.3
Network (NI to NI) Parameters - (Calculated Values)												
13. 1004 Hz Loss		dB	15.2	15.2	24.3	13.2	15.9	16.1	16.1	15.7	18	17.3
14. 2804 Hz Slope (Attenuation Distortion)		dB	1.4	9	6.8	1.4	3	10.3	10.3	8.9	2.3	2.5
15. 1004 Hz Signal To Far End Echo Ratio at Modem B		dB	17	20	19.1	6	8.7	10.9	10.9	20.5	10.8	19.1
16. 1004 Hz Signal to Listener Echo Ratio at Modem B		dB	44	40	44	27	31	31	31	40	31	48
17. Frequency Offset of Far End Echo (Phase Roll)		Hz	0	0	-0.5	9	0	1	0	0	0	0

FIGURE 04-7: BLOCK DIAGRAM OF NETWORK SIMULATOR
EIA TELECOMMUNICATIONS SYSTEM BULLENTIN 37



SECTION 8 - SYSTEM DIAGRAMS

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Figure 32: PTT 5102 MODEM TEST SYSTEM

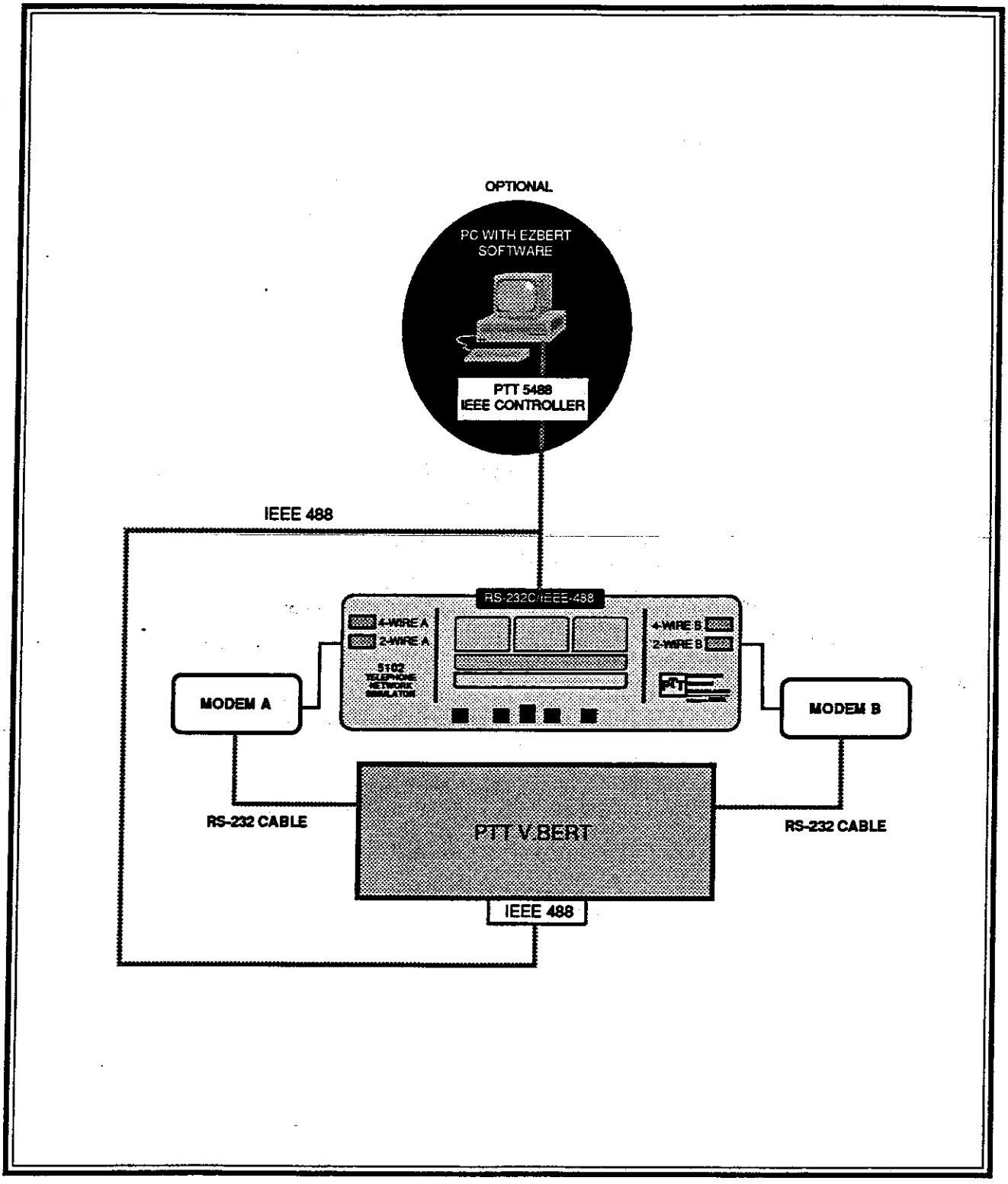


Figure 33: UNIDIRECTIONAL MODEM TEST SYSTEM

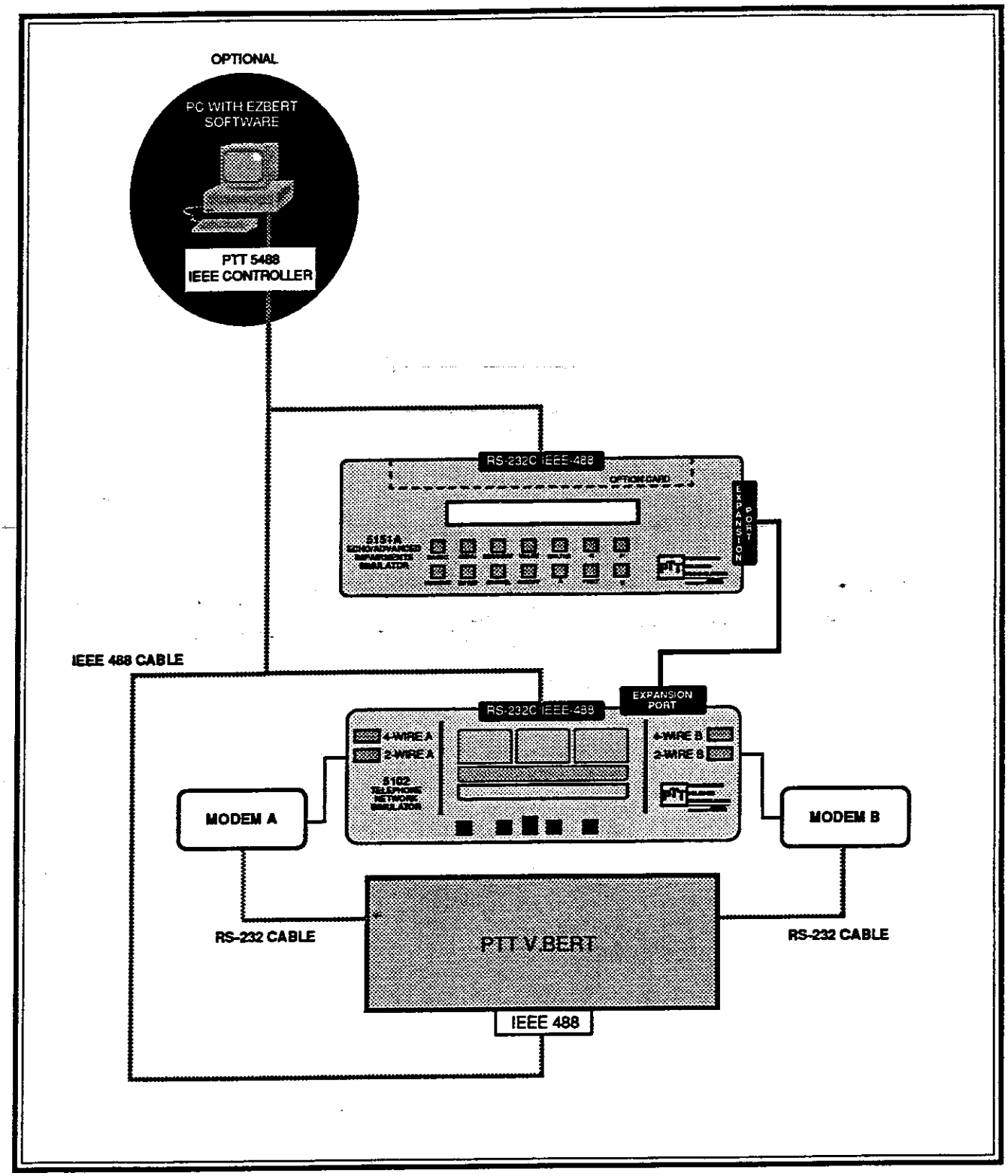
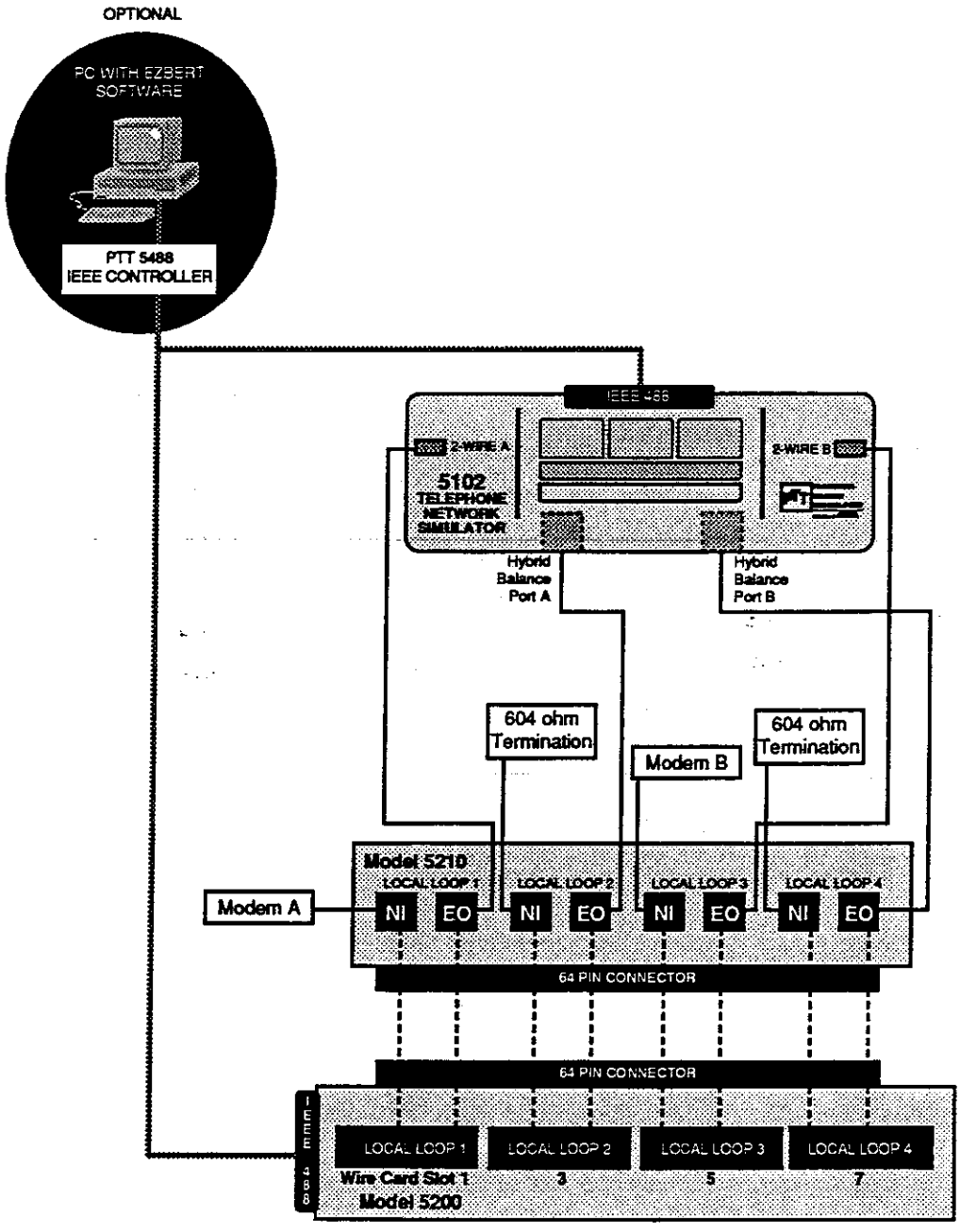
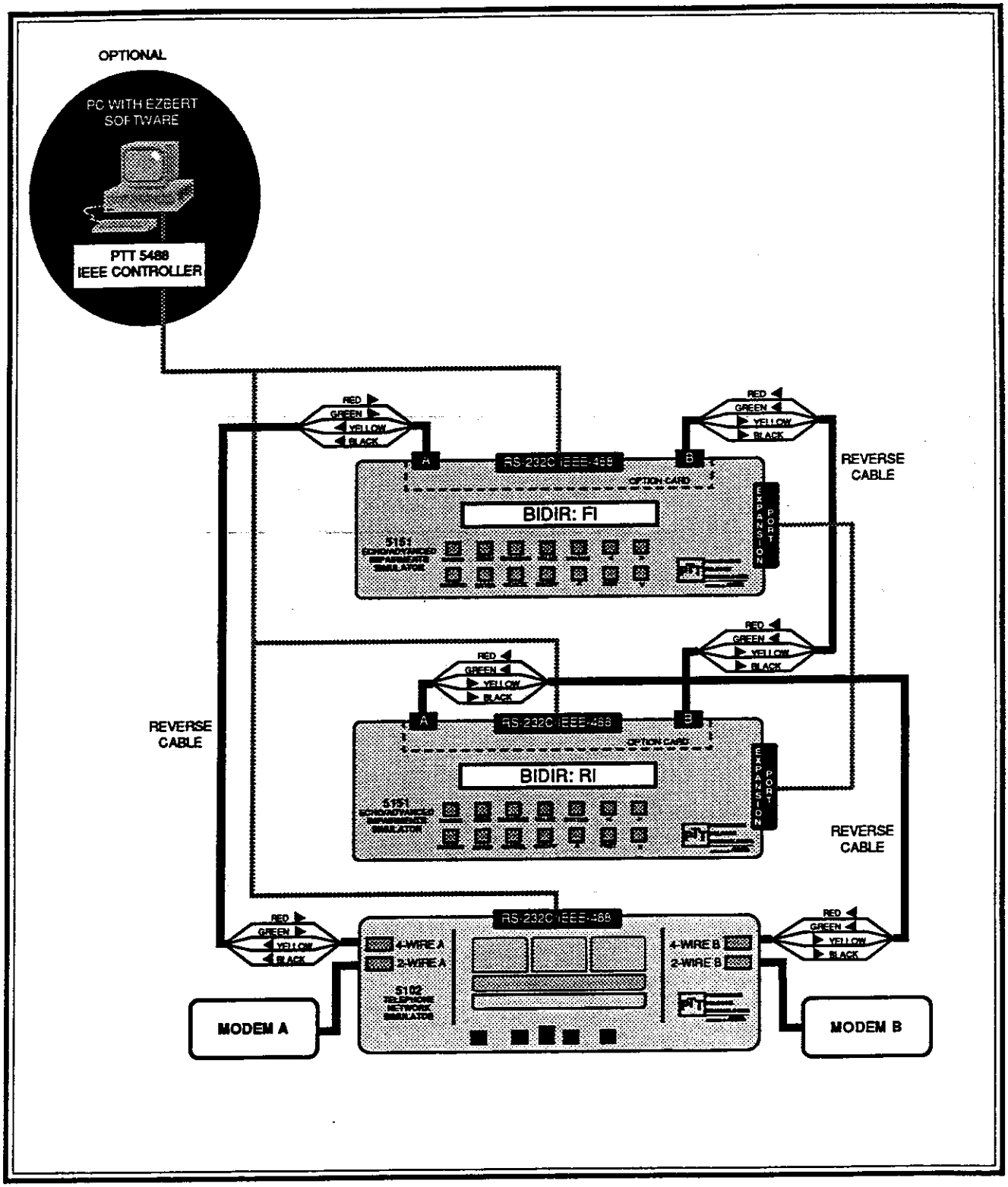


Figure 34: MODEL 5210 LOCAL LOOP ADAPTOR



*Dotted lines represent the 64 pin ribbon cable connection between the Model 5210 and 5200

Figure 35: BIDIRECTIONAL MODEM TEST SYSTEM



SIGNAL FLOW DIAGRAMS

The following diagrams illustrate the signal flow within the 5102 in several key operating modes.

Figure 36: 2-Wire Normal Operating Mode

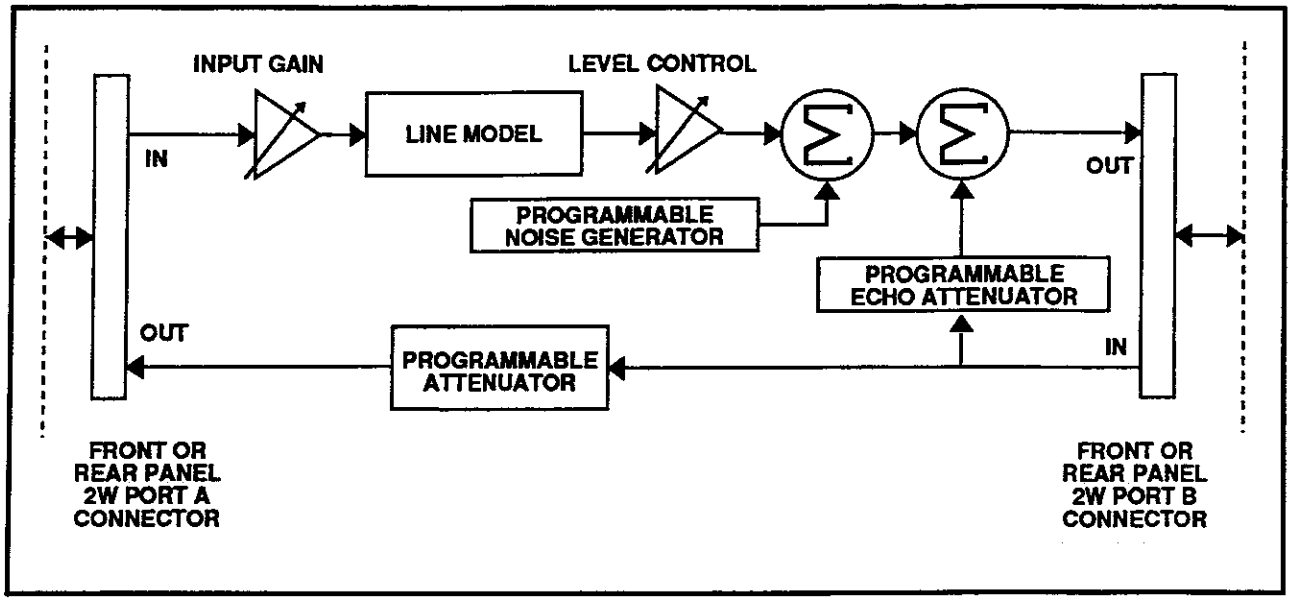


Figure 37: 2-Wire Ports Reversed Operating Mode

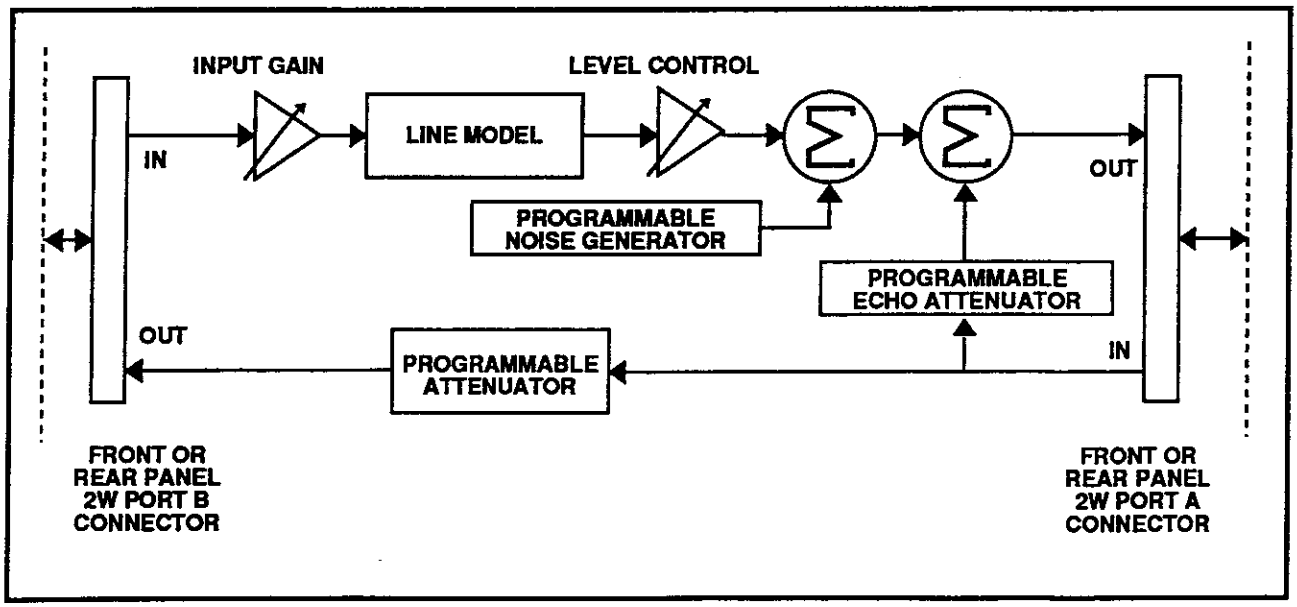


Figure 38: 4-Wire Normal Operating Mode

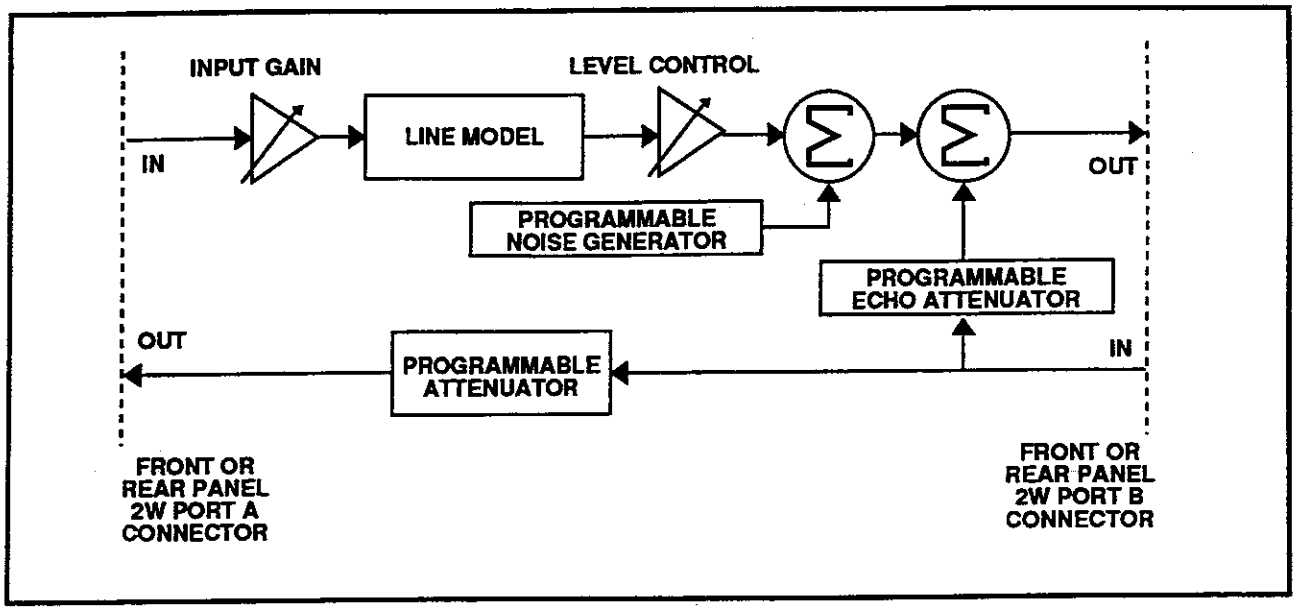


Figure 39: 4-Wire Ports Reversed Operating Mode

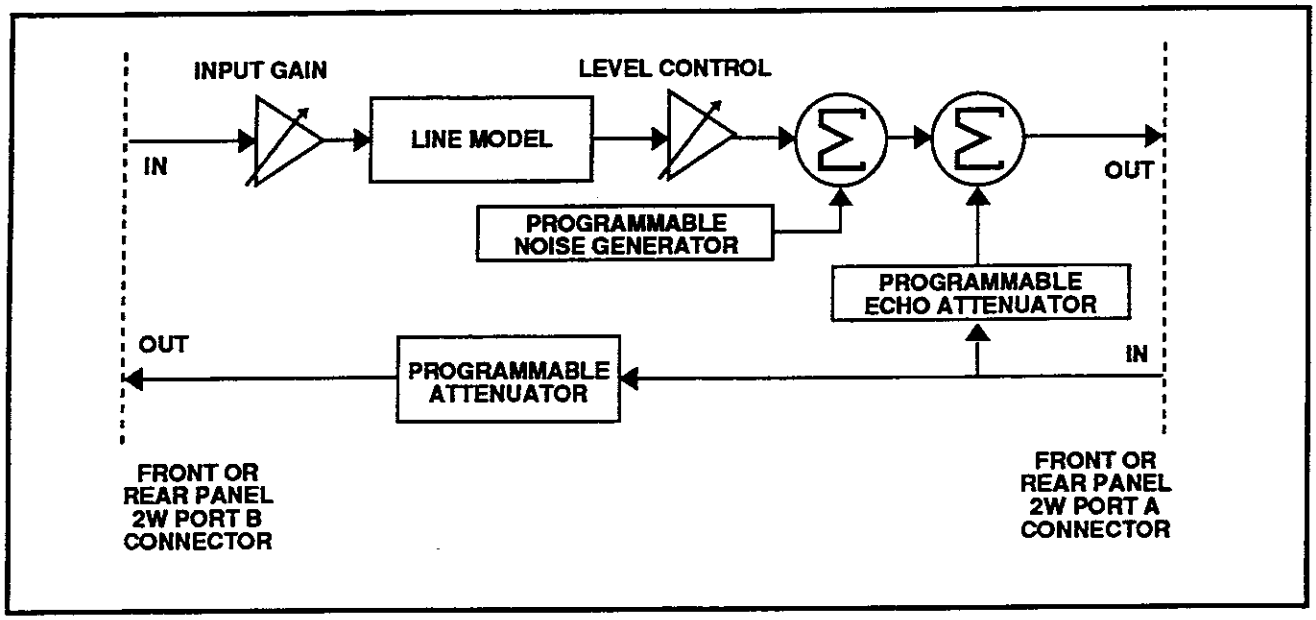


Figure 40: 2-Wire External (Impariment) Path Mode

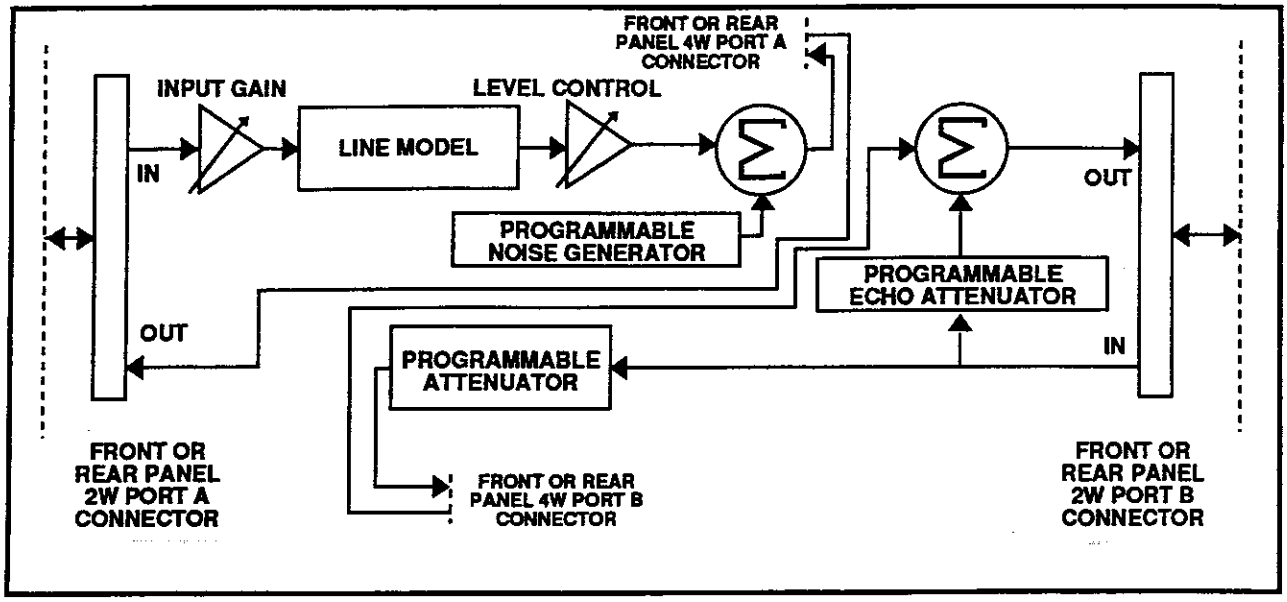


Figure 41: 2-Wire Back-To-Back Mode

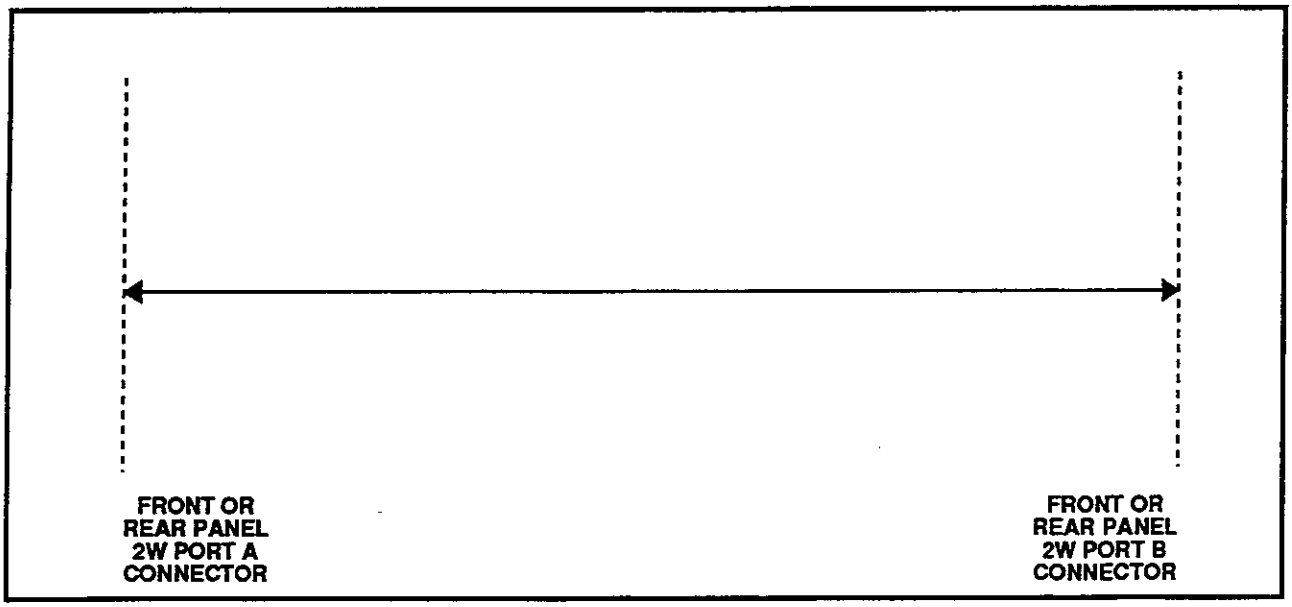


Figure 42: 4-Wire Back-To-Back Mode

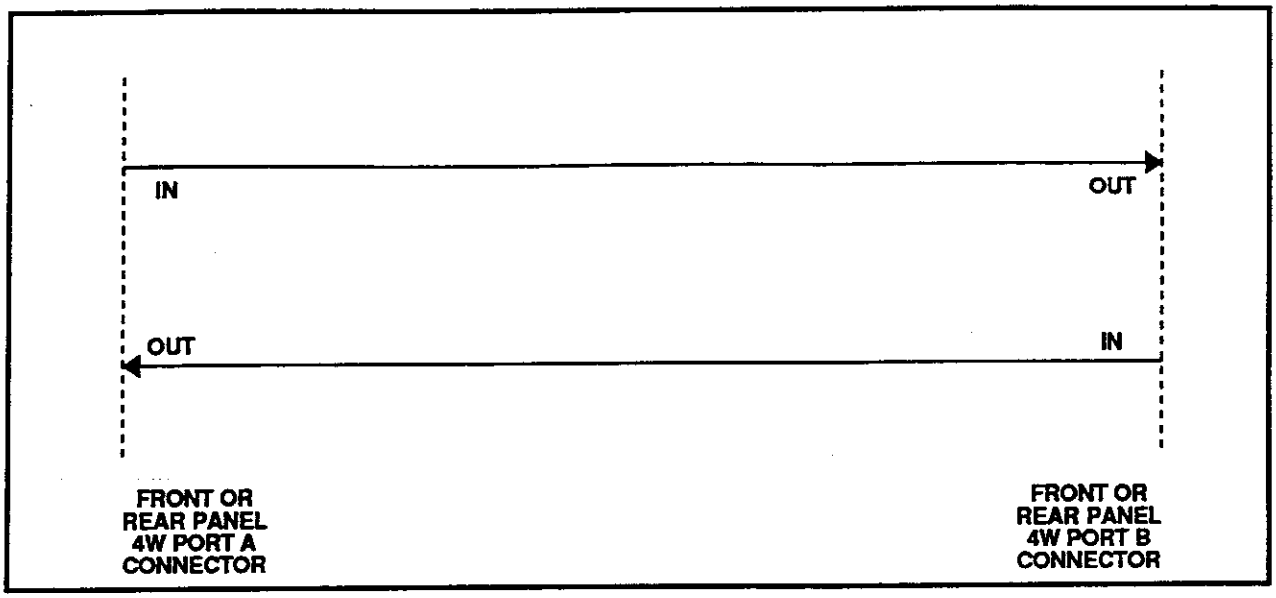


Figure 43: 4-Wire With PORT A Loopback Mode

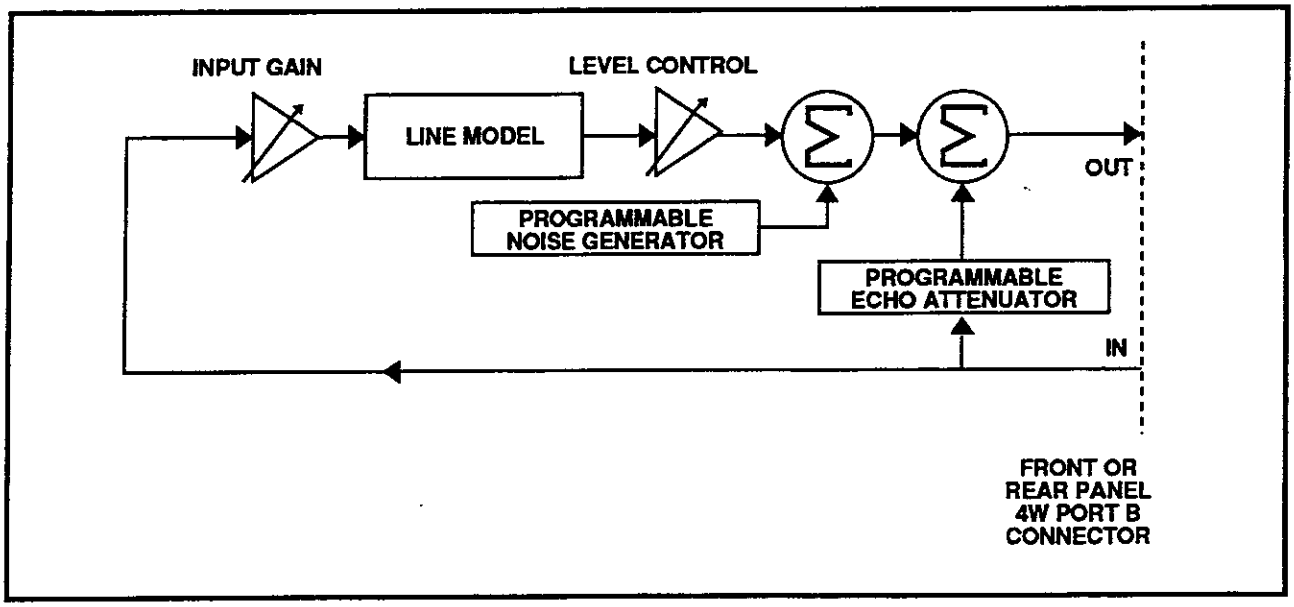


Figure 44: 4-Wire With PORT B Loopback Mode

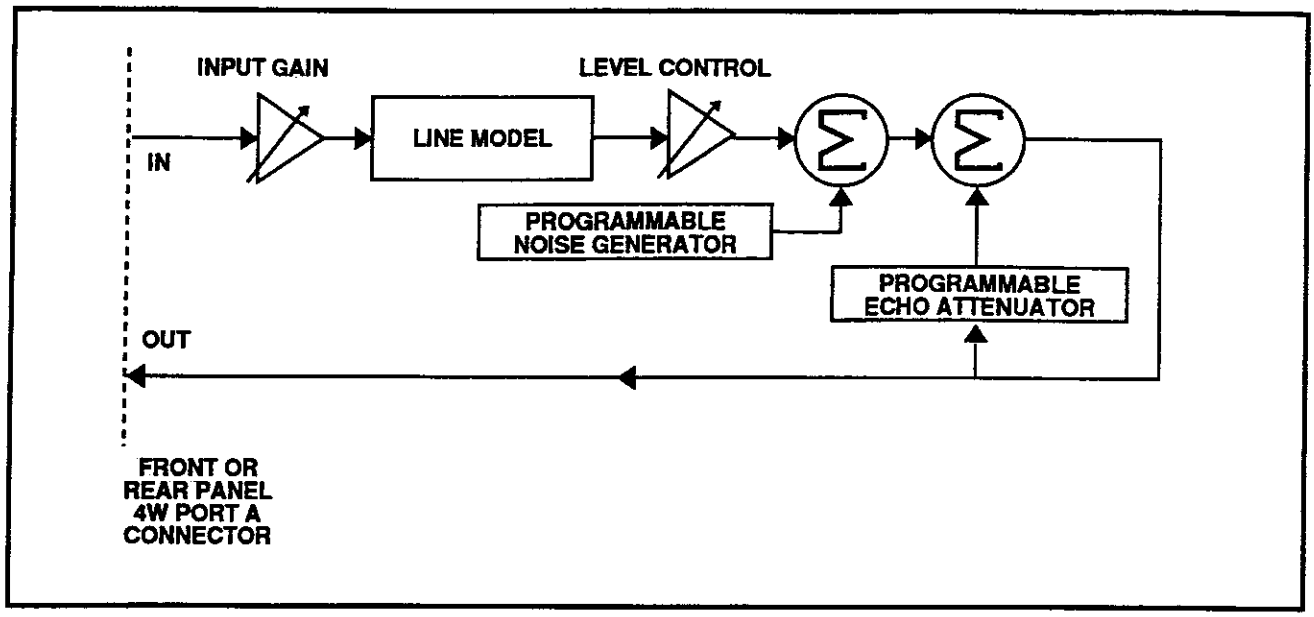


Figure 45: 4-Wire PORT A to 2-Wire PORT B Mode

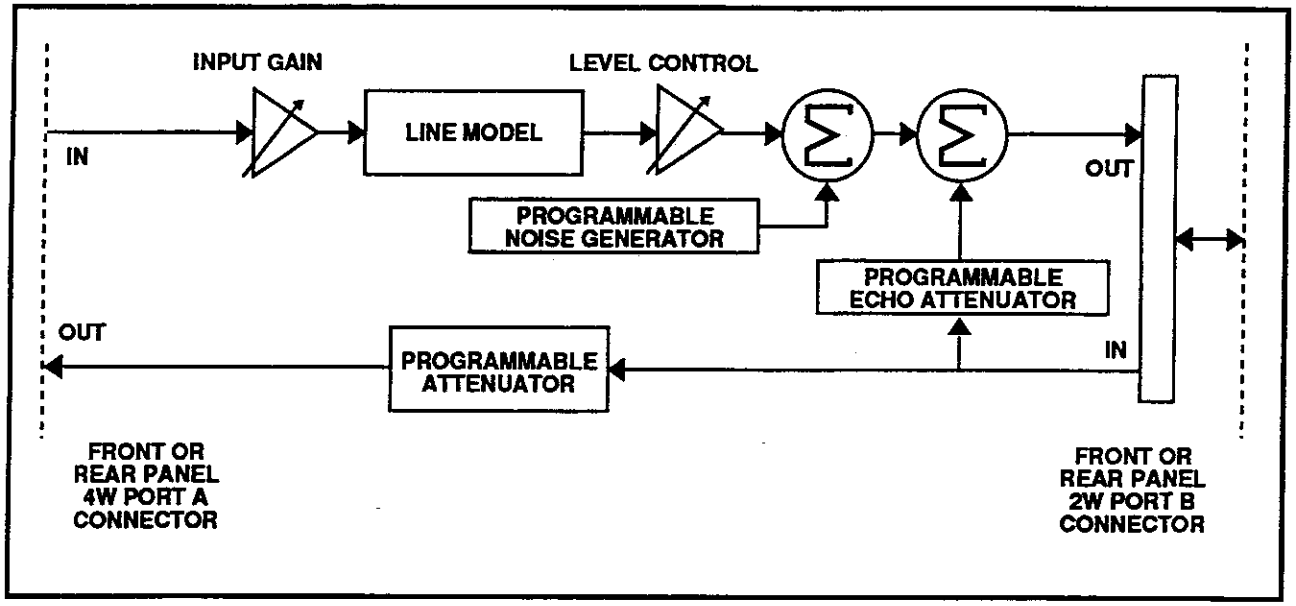


Figure 46: 2-Wire PORT A to 4-Wire PORT B Mode

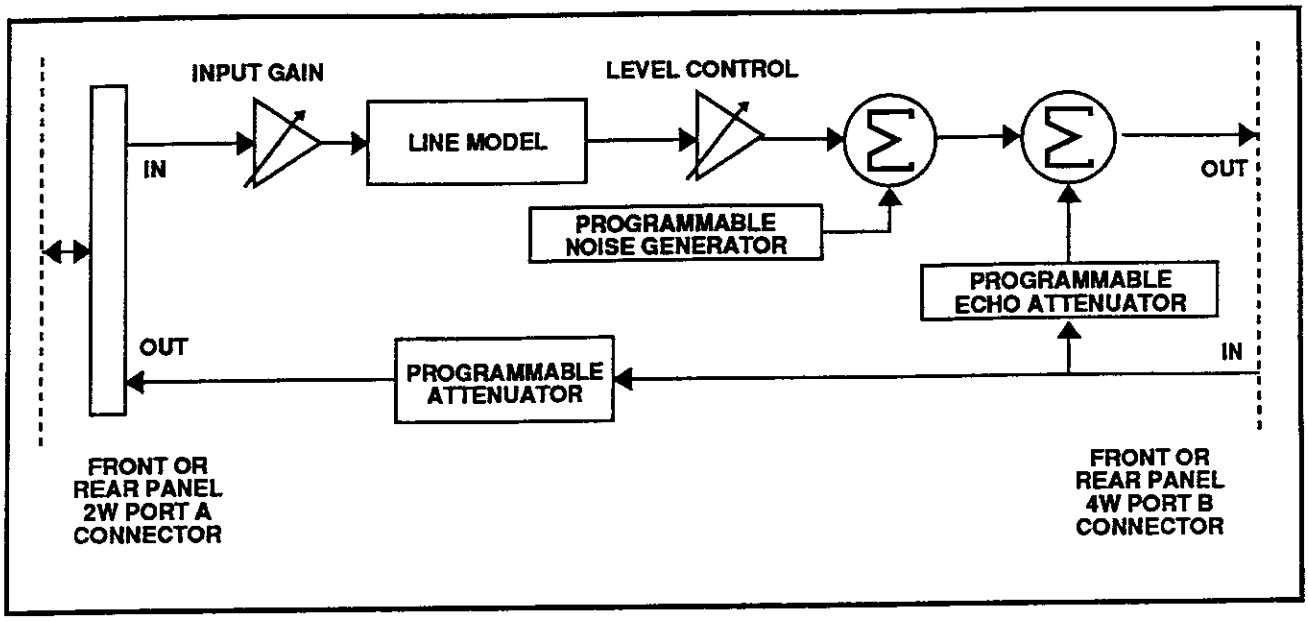
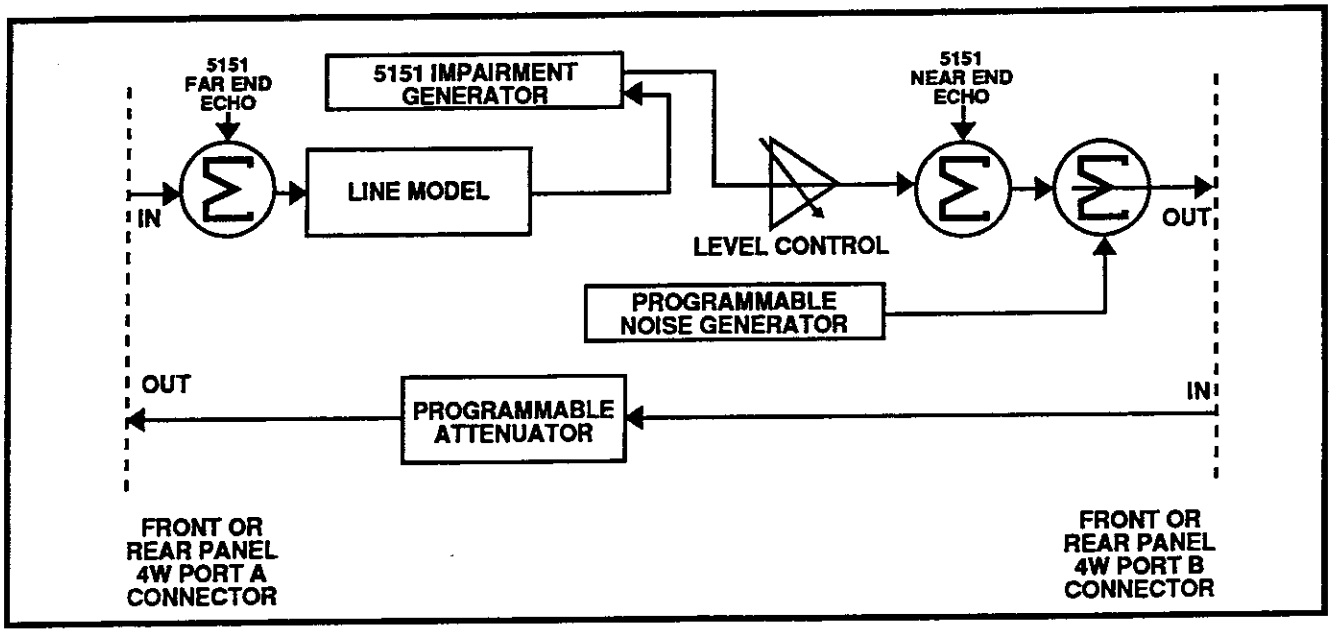


Figure 47: 4-Wire Mode With PTT 5151 Echo/Advanced Impairments Simulator



SECTION 9 - MAINTENANCE

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MAINTENANCE

EPROM REPLACEMENT

1. Turn power off at the rear panel power switch. Disconnect the power cord.
2. Remove four screws, two on each side of the top housing, (above the handle). Remove the top cover of the unit housing.
3. The three EPROMS are located on the Main Board in the center of the unit. The Main Board is the one closest to the bottom of the housing. Each EPROM is labeled with a PTT part number identifying the particular Firmware of the EPROM.
4. The reference designation for each EPROM is printed on the board. The EPROMS should be installed in the appropriate socket:

9000.5102-1X	U53
9000.5101-124X-L	U16
9000.5101-124X-H	U17

Note: "X" denotes the revision letter of the Firmware.

5. Remove the EPROM that is to be replaced.
6. Install the new EPROM, being careful to maintain the correct orientation of pin 1 on the IC.
7. Replace the top cover of the unit housing and secure with the four screws.
8. Re-connect the power cord.
9. Perform a Factory Power-up Procedure by holding the two scroll buttons down while turning on the power.

2-WIRE IMPEDANCE STRAPS

The optional 2-Wire termination impedance can be selected through straps on a daughter card in the 5102.

Note: The factory default is the 600 ohm position.

1. Turn power off at the rear panel power switch. Disconnect the power cord.
2. Remove four screws, two on each side of the top housing, (above the handle). Remove the top cover of the unit housing.
3. Locate the straps marked Exx, where "xx" is a number from 1 through 14. These straps are located on the daughter card that is nearest the front panel.
4. An indication for 600 and 900 ohm selection is noted beside each strap as a "6" and a "9" on the card. Set each strap for the desired termination impedance.
   Note: All straps must be set to the same position.
5. After setting all 14 straps, replace the top cover of the unit housing and secure with the four screws.
6. Re-connect the power cord, and turn the unit on.

RJ45 Pin Assignment Selection

This procedure is used to select the wire pairs on the RJ45 used for transmit and receive. The inner mode uses the inner two pairs (pins 3,4,5,6) and the outer mode uses the outer two pairs (pins 1,2,7,8). The PIN assignment for each mode is:

	Inner Mode	Outer Mode
Transmit HI	4	1
Transmit LO	5	2
Receive HI	3	7
Receive LO	6	8

Note: The factory default is the Inner 4 wire selection.

1. Turn power off at the rear panel power switch. Disconnect the power cord.
2. Remove four screws, two on each side of the top housing, (above the handle). Remove the top cover of the unit housing.
3. Note the three cables going into the front panel. At the end closest to the front panel, disconnect these three cables.
4. Remove the four outside screws that secure the front panel in place. Remove the front panel.
5. Looking down from the top edge of the front panel, notice that between the front panel and the printed circuit board, and near both outside edges are two red dip switches (numbered 1 - 8) which control the mode settings for Port A and Port B.
6. A narrow tool such as an opened paper clip, the tip of a pencil or pen, can be used to change the dip switch settings.
7. Normally dip switch settings are referred to as ON or OFF. In the following table the ON position is indicated as "ON (R)", as the switch should be pushed away from the front panel toward the Rear. The OFF position is indicated as "OFF (F)", as the switch should be pushed toward the Front panel.
8. The switch positions for each mode, Inner and Outer, are:

PIN	INNER	OUTER
1	OFF(F)	ON (R)
2	OFF(F)	ON (R)
3	ON (R)	OFF(F)
4	ON (R)	OFF(F)
5	ON (R)	OFF(F)
6	ON (R)	OFF(F)
7	OFF(F)	ON (R)
8	OFF(F)	ON (R)

9. Install the front panel assembly on the 5102 and secure with the four outside screws that have been removed.

10. Re-connect the three cables that were removed from the front panel to their appropriate position.
11. Install the top cover on the unit and secure with the four screws that have been removed.

Fuse Replacement

The fuse holder (also the voltage selector) is a black inset positioned just above the power cable connector on the rear panel. It has a small window which displays the voltage number printed on a light grey inset. The required fuse is a 1.6A, 250V. To replace a fuse:

1) Grasp the left and right seating brackets of the fuse holder, squeeze both sides together and remove with a pulling action. It should slide out fairly easily.
2) With a simple pull out motion, remove the light grey inset which holds the fuse. Note the four voltage selections stamped on the end of the inset.
3) Remove the blown fuse, and replace the new one into the fuse holder.
4) Position the fuse holder so the voltage select numbers read from bottom to top and replace it into the back panel. It should re-seat with a snapping sound.

CUSTOMER SERVICE INFORMATION

The Troubleshooting section of this manual, Section 10, was developed to specifically assist users of the PTT Model 5102 with any operational problem they might encounter. In addition, assistance for users is readily available from the Customer Service Manager and staff. Please feel free to write, call or FAX your questions or comments.

Customer Service Manager
Processing Telecom Technologies
901 Explorer Boulevard
Huntsville, Alabama 35806-2807
Telephone: 1-800-998-7880
FAX: (205) 971-8751

The PTT Telephone Network Simulator Model 5102 is under warranty for a period of one year according to the warranty statement in the Introduction Section of this manual. In resolving service problems, procedures outlined therein should be followed.

SECTION 10 - TROUBLESHOOTING

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CALIBRATION VERIFICATION

When trying to set up the calibration for a test, some confusion can result simply from the multiple options available in the 5102. One of the most common sources of error is the AGC and System Calibration process. The following calibration verification should function as a guide to determine that the 5102 is calibrated and operating correctly.

VERIFY 4 WIRE PATH USING MODEM

This test provides a simple method for verifying the forward path operation. It does not require any additional equipment. (This test can be performed in 2-wire or 4-wire mode.)

1. Set FLAT Linetype
2. Turn Noise OFF
3. Turn Near End Echo OFF
4. Set Attn = 10 dB
5. Transmit modem signal into Port A
6. Measure Input power on A using the PWR Measure feature of the 5102
7. Verify the transmit level is correct
8. Perform signal AGC
9. Measure output power on Busing the PWR Measure feature of the 5102
10. Verify the output is correct by the following formula:
    Transmit - 10dB = Output

END TO END CALIBRATION CHECK

This method provides a way to test the 5102 from one network interface to the other. This procedure **does** require external test equipment.

1. Select 2-Wire or 4-Wire mode
   (For 2-Wire mode, set Loop Current = 0mA)
2. Input A -6 dBm, 1004 Hz Sine wave into the network interface (Port A or B). The signal source should have a 600 ohm source impedance and be connected across Red and Green wires on a telco cable.
3. Set FLAT Linetype
4. Turn Noise OFF
5. Turn Near End Echo OFF
4. Set Attn = 10 dB
5. Perform a signal AGC
9. Measure signal at input to 5102. Verify = -6 dB. (Must be measured with a true RMS DVM across Red & Green wires of the telco cable.)
10. Perform input power measure in the 5102. Verify that it equals -6 dBm.
11. Connect a 600 ohm load to the output Port.
    2-Wire mode - connect across Red and Green wires on a Telco cable.
    4-Wire mode - connect across Yellow and Black wires
12. Measure the signal level on the output load using a true RMS DVM
13. Verify that the level = -16 dBm

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901 Explorer Boulevard
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Telephone: 1-800-998-7880
FAX: (205) 971-8751

The PTT Telephone Network Simulator Model 5102 is under warranty for a period of two years according to the warranty statement in the Introduction Section of this manual. In resolving service problems, procedures outlined therein should be followed.

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