# Spirent Communications
# TAS 4600A
# Noise and Interference Emulator
# Operations Manual

### SAFETY SUMMARY

If the equipment is used in a manner not specified by the manufacturer the protection provided by the equipment may be impaired.

### SAFETY SYMBOLS

The following safety symbols are used throughout this manual and may be found on the instrument.  Familiarize yourself with each symbol and its meaning before operating this instrument.

| | | | |
|---|---|---|---|
| ⚠ | Instruction manual symbol.  The product is marked with this symbol when it is necessary for the user to refer to the instruction manual to protect against damage to the instrument. | ⊓ | Frame terminal.  A connection to the frame (chassis) of the equipment which normally includes all exposed metal structures. |
| ⏚ | Protective ground (earth) terminal.  Used to identify any terminal which is intended for connection to an external protective conductor for protection against electrical shock in case of a fault, or to the terminal of a protective ground (earth) electrode. | **Caution** | The caution sign denotes a hazard.  It calls attention to an operating procedure, practice, condition or the like, which, if not correctly performed or adhered to, could result in damage to or destruction of part or all of the product or the user's data. |
| ⚡ | Indicates dangerous voltage (terminals fed from the interior by voltage exceeding 1000 volts must be so marked). | ∿ | Alternating current (power line). |

## TABLE OF CONTENTS

# 1.0. INTRODUCTION

## 1.1. Overview

The TAS 4600A Noise & Interference Emulator provides a convenient, thorough approach for testing RF communications equipment by emulating the co-channel and adjacent channel interference present in wideband communications systems. The TAS 4600A allows thorough testing in a laboratory setting and drastically reduces the time required for product tests. By providing precise carrier to noise (C/N) and carrier to interference (C/I) conditions, the TAS 4600A can be used to test a wide range of wireless voice and data communication equipment, including cellular telephones, cellular modems, personal communication terminals, wireless LANs, pagers, and wireless network equipment.

TAS 4600A provides advanced testing features to address a wide range of RF communications technologies. The 4600A delivers these features in a modular format, so your test system can evolve to meet your testing needs for years to come. The TAS 4600A has the following modular features:

- Plug-In RF Channel Modules

- Plug-In CW Interference Module

- Plug-In RF Power Meter

- Plug-In System Software PCMCIA Card

A single TAS 4600A emulates up to two independent wide bandwidth RF channels, each with independent additive interference, see Figure 1-1. A wide range of  C/N, $E_b/N_0$,  and C/I characteristics can be programmed  for each channel.  In addition, the 4600A allows the output power of each RF channel to be directly programmed over a wide dynamic range to allow testing at very low carrier levels.
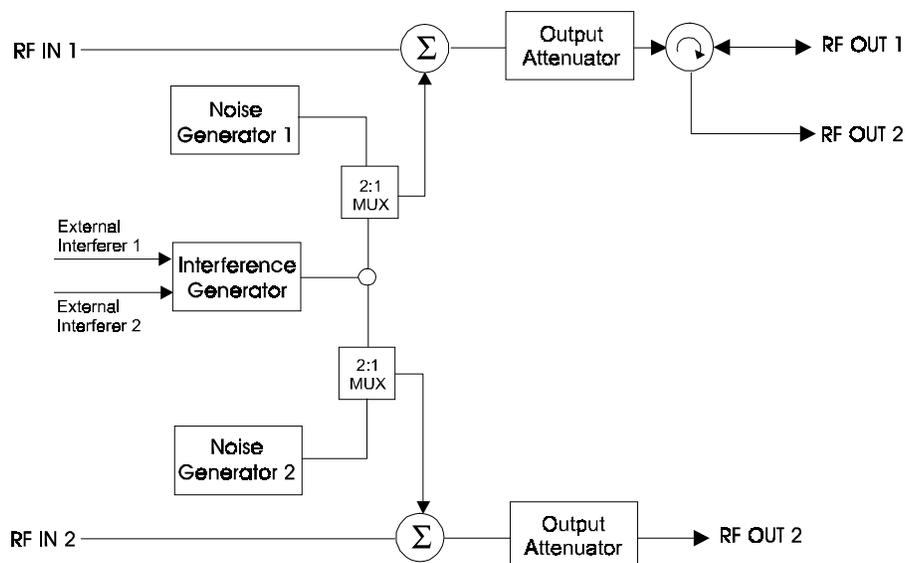
**Figure 1-1. TAS 4600A Block Diagram**

### 1.1.1. Product Highlights

TAS 4600A provides powerful features and a level of integration that are unique for an instrument of this type.  These include:

- Wideband noise & interference emulation capability exceeds requirements of many wireless communications standards, including IS-97A/98A, J-STD-018/19, and the CDG Interoperability Tests.

- Unprecedented two channel capability for the most integrated diversity receiver testing for applications such as CDMA base station evaluation.

- Integrated instrument grade RF Power Meter provides accurate RMS power measurements and C/N ratio settings.

- Optional built-in dual-tone synthesizer makes it possible to perform receiver testing under various CW interference conditions.

- Wide dynamic range output level control provides the means for testing down to low carrier receive signal levels without the need for external programmable attenuators.

- FLASH-memory based calibration constants specific to the instrument enable output power levels and C/N ratios to be set with a high degree of accuracy and repeatability.

- TAS 4600A's modular architecture lets your test system capabilities grow as your testing requirements grow.  The modular 4600A  architecture lets you select the number of RF channels and impairments required to fit both existing and future testing applications.

- Standard dual-band RF modules completely address the testing needs of both cellular and PCS applications in a single instrument.

- Built-in configurations for industry-standard test procedures.

- GPIB and RS-232 control ports make it easy to include TAS 4600A in automatic test systems.

- Field-upgradable PCMCIA System Software Card allows quick and easy access to the latest firmware revisions and features.

### 1.1.2. TAS 4600A Applications

The TAS 4600A provides many emulation features for testing wireless and RF communications equipment for product development, manufacturing and evaluation applications.

### Product Development and Engineering Test

Product development and engineering test organizations can use the TAS 4600A to test and evaluate the performance of wireless communications equipment in the presence of real world conditions such as co-channel and adjacent channel interference.  Repeatable and realistic testing is crucial to the successful development of wireless systems because they typically require complex signal processing techniques to mitigate the effects of RF channel impairments.

### Quality Assurance (QA) Testing

The QA organization of a wireless equipment manufacturer can use the TAS 4600A to monitor product quality by testing if the manufactured product is consistently meeting the targeted performance levels. This can be a major issue particularly for high volume products such as cellular telephone and modems.

### Evaluation and Acceptance Testing

Communications equipment users often need to evaluate the performance of wireless and RF communication equipment as part of their procurement process for such equipment. This typically requires the equipment from candidate suppliers to be tested against an established set of performance specifications. These types of tests require test equipment that is very reliable, accurate and easy to use. The TAS 4600A possesses these characteristics and provides the functionality for the user to evaluate wireless communication equipment against a wide variety of domestic and international testing specifications.

## 1.2. Guided Tour

The front panel keys and display provide access to all the features of the TAS 4600A.  The front panel enables the definition of channel characteristics, measurement of signal levels, set up of general system configuration parameters, and saving and recalling configuration files.

### 1.2.1. Front Panel Description

Figure 1-2 shows the TAS 4600A front panel.  The following sections describe each front panel feature.

The buttons and displays on the front panel of the TAS 4600A are partitioned into logical groups to provide a user friendly interface.  These consist of a SELECT/EDIT group, a MENU group, an AUTOSET group, and a BYPASS group.   The MENU group contains the CHANNEL 1, CHANNEL 2, MEASURE, CONFIG, and FILE KEYS.  The SELECT/EDIT group contains the UP, DOWN, LEFT, and RIGHT arrow keys; the PLUS, MINUS, ENTER, and ESCAPE keys; the CURSOR LEFT and CURSOR RIGHT keys; and the LOCAL key.  The AUTOSET group contains the CHANNEL 1 and CHANNEL 2 Autoset keys and LEDs.  The BYPASS group contains the Bypass keys and LEDs.
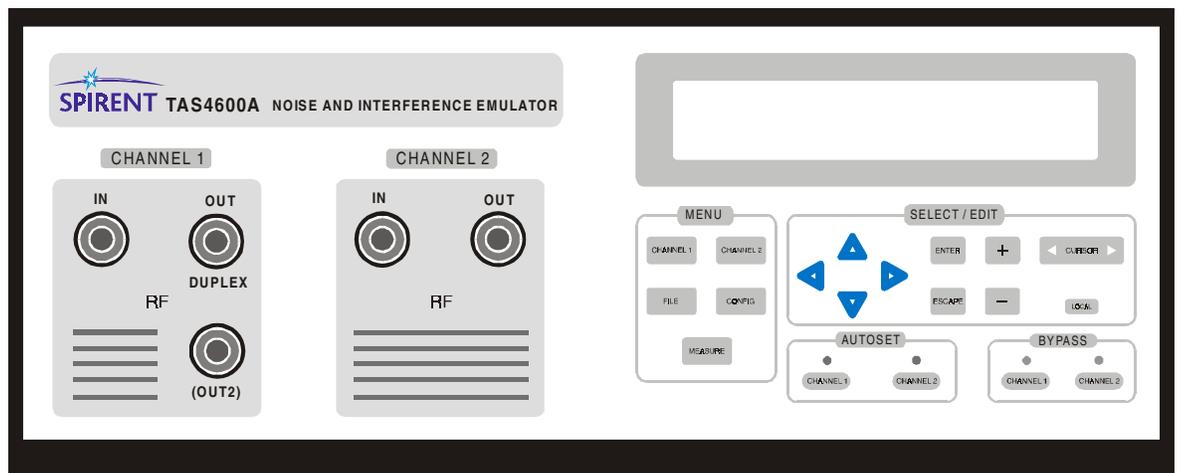


**Figure 1-2.  TAS 4600A Front Panel**

## Front Panel Buttons and Displays

### CHANNEL 1 Key
The channel 1 menu group controls the simulated unidirectional RF impairment channel. This menu group allows I/O parameters (carrier frequency, output level) as well as RF channel parameters (impairment mode, interference ratio) to be viewed and controlled.

### CHANNEL 2 Key
The channel 2 menu group controls the second simulated unidirectional RF impairment channel. This menu group allows I/O parameters (carrier frequency, output level) as well as RF channel parameters (impairment mode, interference ratio) to be viewed and controlled.

### MEASURE Key
The measure menu group controls the instrument's RF power meter measurement function. The measure menu provides access to the input carrier signal measurement function and the configuration of the internal RF power meter.

### CONFIG Key
The configure menu group allows the configuration of the remote control interface, displays the instrument's software version and diagnostic status, selects the displayed units for the impairment characteristics, and sets the LCD contrast.

### FILE Key
The file menu group allows you to load both user and TAS defined parameter profiles and to save user defined parameter configurations.

### Menu Navigation Up & Down Arrow Keys
The Menu Navigation Up & Down Arrow keys are used to move between screens of the same menu, and to move among rows on the same screen. They are located together with the Menu Navigation Left & Right Arrow keys as a group under the left hand side of the front panel display.

### Menu Navigation Left & Right Arrow Keys
The Menu Navigation Left and Right Arrow Keys move the cursor between parameter fields of the same menu screen. They are located together with the Menu Navigation Up & Down Arrow keys as a group under the left hand side of the front panel display.

### Cursor Left & Right Arrow Keys
The Cursor Left and Right Arrow Keys move the cursor between digits within a parameter field.

**ENTER Key**

The ENTER key accesses a submenu. A carriage return symbol (↵) appears at the right side of each menu item that has a submenu.

**ESC Key**

The ESC key allows you to exit a submenu, or clear an error condition.

**PLUS & MINUS Keys**

The Plus and Minus keys are used to modify the value of the parameter field that is currently active. The Plus key increments the value of the field while the Minus key decrements the value of the field.

**CHANNEL 1 and CHANNEL 2 AUTOSET Keys**

These keys are located near the lower center of the front panel to provide direct access to the autoset function for both channels. Pressing this key causes the instrument to execute the currently programmed conditions for the channel selected.  After an autoset function has been successfully completed, a green LED will be illuminated.

**CHANNEL 1 and CHANNEL 2 BYPASS Keys**

The bypass keys enable and disable the bypass feature for each channel.  When the bypass for a channel is active, the bypass LED will be illuminated.  When bypass is enabled, a minimum-loss, no-impairments path from the RF IN connector to the RF OUT connector is created.

**LOCAL Key**

The Local key disables remote control operation.  When remote operation is enabled, menu parameters cannot be changed from the front panel.  However, the menu navigation keys can still be used to view parameter values.  The letter 'R' appears in the upper right corner of the display when the 4600A is in Remote Control Mode.

**Main Display**

The main display is located in the upper right quadrant of the front panel.  It shows all control menus and level measurement results.

## Signal Input/Output Connectors

**RF Input/Output N-Connectors**

There are three N-type connectors associated with Channel 1 and two N-type connectors associated with Channel 2 on the upper left side of the TAS 4600A front panel.  On the standard TAS 4600A, the IN and OUT connectors serve the same functions for both channels, and the third N-type connector [OUT 2] on Channel 1 is not present.  If the Duplexer option is installed, then the Channel 1 OUT connector [DUPLEX] becomes a bi-directional port and the third N-type

connector [OUT 2] on Channel 1 becomes an output for any signal transmitted into the Channel 1 OUT [DUPLEX] port. Figure 1-3 illustrates a functional diagram of the TAS 4600A internal connections.
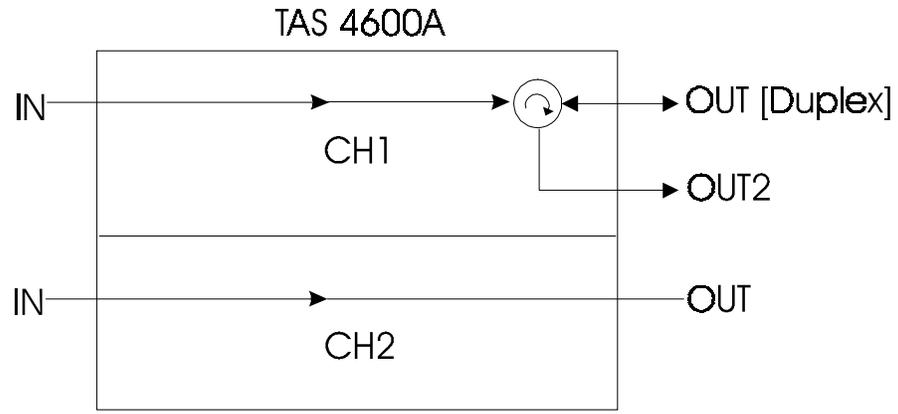


**Figure 1-3. Functional Diagram of TAS 4600A Connectors**

### 1.2.2. Rear Panel Description

Figure 1-4 shows the TAS 4600A rear panel.  The following sections describe each rear panel feature.
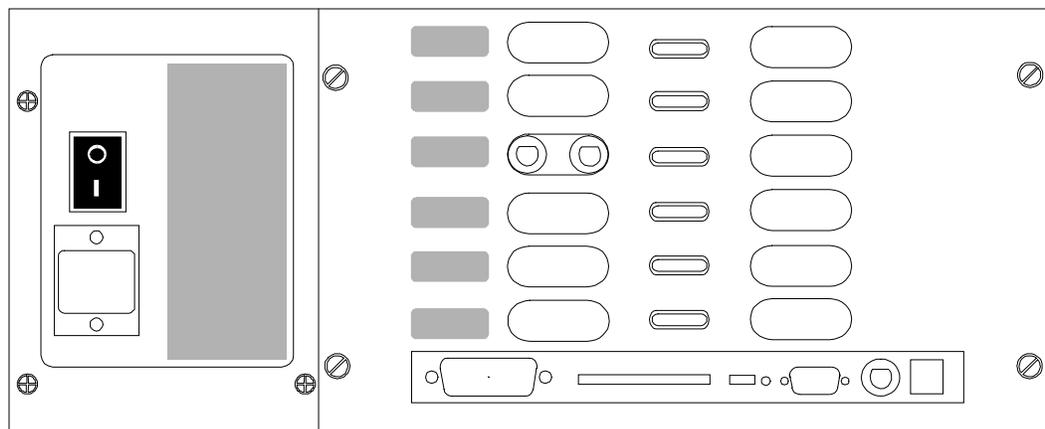


**Figure 1-4. TAS 4600A Rear Panel**

**PCMCIA System Software Interface**
The system software for the TAS 4600A is resident on a PCMCIA memory card which plugs into the PCMCIA System Software Interface on the lower portion of the instrument's rear panel.  This PCMCIA card makes it easy to upgrade to the latest firmware version.

**IEEE-488 Remote Control Port**
The CONTROL (IEEE-488) port is a 24 pin IEEE-488 receptacle which supports the IEEE-488 (GPIB) protocol.  This port must be connected to an IEEE-488 controller to control the TAS 4600A via IEEE-488.  This connection may be either direct or via multi-point bus which contains other IEEE-488 controlled equipment.

The IEEE-488 controller can be a generic PC with an embedded IEEE-488 control card installed, a IEEE-488 computer, an RS-232 to IEEE-488 converter, or some other IEEE-488 controller.

**RS-232C Remote Control Port**
The CONTROL (DCE) port is a 9 pin D-sub connector which supports RS-232C. The control port is wired as a Data Communications Equipment (DCE). All RS-232C remote control of the TAS 4600A must be done via this port. An RS-232C terminal or a PC (IBM compatible) can control the TAS 4600A through this via a regular RS-232 cable. It is important to note that a null modem cable is not required. Two protocols are supported in RS-232 control mode, ACK/NAK (ACKnowledge/Negative ACKnowledge), and CR/LF (Carriage Return/Line Feed). Both of these protocols are explained in full detail in the REMOTE OPERATION section of this manual.

**AUX Port**
The AUX (auxiliary) port is a RJ-45 connector that is currently not used.

**Dual External Interferer Interface**
A pair of external interference inputs are located on the rear of the TAS 4600A. These two SMA type connectors are labeled EXT A and EXT B. Interference signals can be input into the instrument and added to the carrier signal in either 4600A channel. The nominal input level into these inputs is 0 dBm. See Section 2.4.3 Selecting the Status of Interference Source A and Interference Source B for further details on using these signal inputs. See Section 7.0 *Technical Specifications* for information regarding the frequency range of these inputs and their maximum input power rating.

**10 MHz External Reference I/O Connector**
The External Reference Input/Output connector is a BNC type connector that is currently not used.

**AC Power Receptacle**
The AC universal power receptacle is located in the lower left corner of the rear panel. This receptacle also contains the fuse for the unit. The AC on/off switch is located just above the AC power receptacle.

**Fan Vent Areas**
The TAS 4600A contains two fan vent areas. One vent area is to the right of the AC power receptacle, the other is on the left side panel. The space near these vents should be unobstructed for proper air flow to cool the TAS 4600A.

## 1.3. Installation

This section describes a simple procedure for installing the TAS 4600A.

### 1.3.1. Quick Start Procedure

To prepare the TAS 4600A for initial operation, perform the following steps:

1. Unpack the TAS 4600A shipping carton.  The carton should contain a packing list as well as all the items shown on the list.

2. Verify that all parts listed on the packing list are contained in your TAS 4600A shipping carton.  Save the shipping carton and packing materials until you have completed the system installation and initial check.  If you must return equipment, please use the original box and packing material.

3. Check each item for physical damage.  If any part appears to be damaged, contact the TAS Customer Service department immediately.

4. Read Section 1.2 of this manual.

5. Follow the installation instructions in Section 1.3.

6. Read Sections 2.1 and 2.2 and perform the exercise described in Section 2.2.

### 1.3.2. Installation Guide

The following information describes the basic steps that should be followed to install the TAS 4600A.

1. Plug one end of the AC power cord into the TAS 4600A, then plug the other end into the AC source.

2. Setup the TAS 4600A for one of the standard test configurations described in Sections 1.3.3. through 1.3.5. or in a user defined configuration.

3. Set the AC power switch (at the upper left corner of the rear panel) to the "1" position.  The TAS 4600A now executes its power-up diagnostics and initialization sequence for a few seconds, while it displays the following message on the LCD display:

```
TAS4600A NOISE AND INTERFERENCE EMULATOR
System diagnostics and initializations
       are currently underway.
Please standby...
```

If the TAS 4600A detects an error, it shows the appropriate error message on the main display.  If the TAS 4600A detects no errors it will display the first line of the Channel 1 menu.

Consult Section 2.0. "Local Operation", for further information.  If you intend to use a computer or data terminal to control the TAS 4600A, consult Section 4.0. "Remote Operation".

> **NOTE:** If the TAS 4600A encounters a failure during its initial diagnostic operation, record the error code displayed on the front panel, and refer Section 6.0. "Error Codes" of this manual.

### 1.3.3. Single Channel Configuration Test Setup

The TAS 4600A may be easily used in a single channel configuration in which an RF transmitter is connected to the emulator's channel input with a compatible receiver connected to the channel output. This setup is illustrated in Figure 1-5 and typically requires the following:
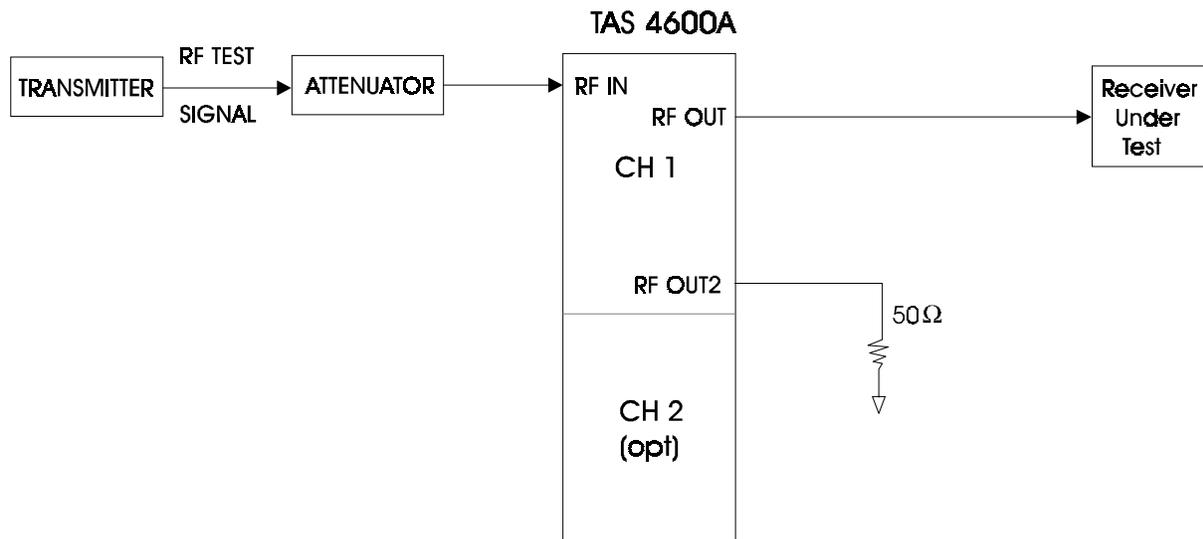


**Figure 1-5.  Single Channel Configuration**

**Signal Interconnect:**

1. Install a cable from the antenna jack of the RF transmitter to the input of a 50 dB RF attenuator.

   The attenuator is required if the transmit power is greater than the specified input signal level range of the 4600A (-10 dBm is the nominal, see technical specifications for limits).  The loss required by the RF attenuator depends on the transmitter's output power.  A 6 watt (38 dBm) transmitter with a 50 dB attenuator would present an input power of -12 dBm (38 dBm - 50 dB).6

2. Install a cable from the output of the RF attenuator to the N type connector on the front panel of the TAS 4600A labeled "CHANNEL 1 RF IN".

3. Install a cable from the N type connector on the front panel of the TAS 4600A labeled "RF OUT" to the input of the RF receiver.

**Parameter Settings:**

4. Basic installation is complete once the equipment has been setup as described in steps 1 to 3 above. You are now ready to set the parameters of the TAS 4600A to the values that are needed to conduct the test.

| Relevant Parameters | Manual Sections |
|---|---|
| C/N Ratio | 2.5.5 |
| C/I Ratio | 2.5.10 |
| Carrier Frequency | 2.5.3 |
| Carrier Output Level | 2.5.4 |
| Receiver Bandwidth | 2.5.6 |
| Status of Interference Source | 2.4.3 |
| Interference Frequency (Internal CW Option only) | 2.4.4 |
| Impairment Status | 2.5.2 |
| Number of Measurement Averages | 2.5.15 |

## 1.3.4. Mobile Station Test Setup

When testing a mobile station with a base station emulator, it is possible to provide a return path on channel 1 if the duplexer option is installed.  In this test configuration channel 1 RF Out port acts as a bi-directional port.  This setup is illustrated in Figure 1-6.
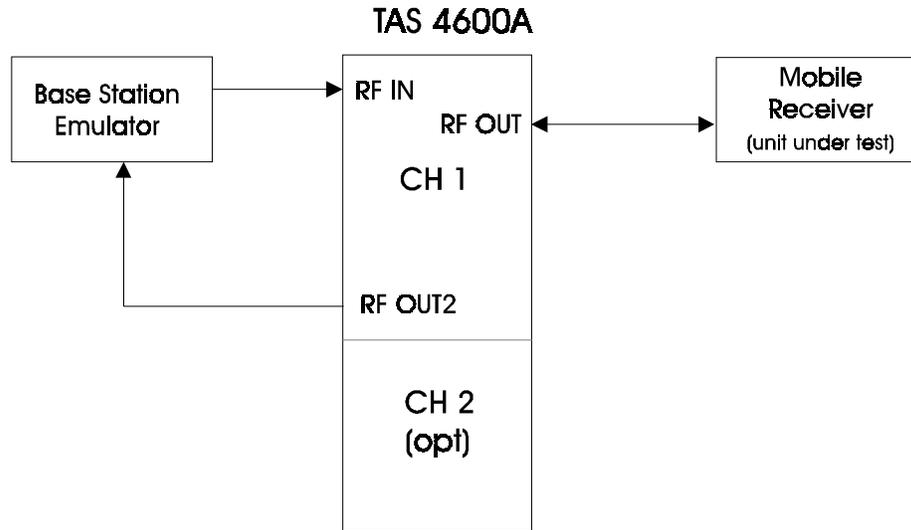
**Figure 1-6.  Mobile Station Testing**

**Signal Interconnect:**

1. Install an N-type cable from the transmit port of the base station emulator to the RF IN port of the TAS 4600A.

2. Install an N-type cable from the receive port of the base station emulator to the RF OUT 2 port of the TAS 4600A.

3. Install a cable from the Mobile Station under test to the TAS 4600A RF OUT port (duplex).

**Parameter Settings:**

4. Basic installation is complete once the equipment has been setup as described in steps 1 to 3 above. You are now ready to set the parameters of the TAS 4600A to the values that are needed to conduct the test.

| Relevant Parameters | Manual Sections |
|---|---|
| C/N Ratio | 2.5.5 |
| C/I Ratio | 2.5.10 |
| Carrier Frequency | 2.5.3 |
| Carrier Output Level | 2.5.4 |
| Receiver Bandwidth | 2.5.6 |
| Status of Interference Source | 2.4.3 |
| Interference Frequency (Internal CW Option only) | 2.4.4 |
| Impairment Status | 2.5.2 |
| Number of Measurement Averages | 2.5.15 |

## 1.3.5. Duplex Channel Configuration Test Setup

The TAS 4600A may be easily used in a duplex channel configuration with a channel in each direction in which transmitter A communicates with receiver B through Channel 1 and transmitter B and receiver A through Channel 2 of the TAS 4600A.  This setup is illustrated in Figure 1-7 and typically requires the following:
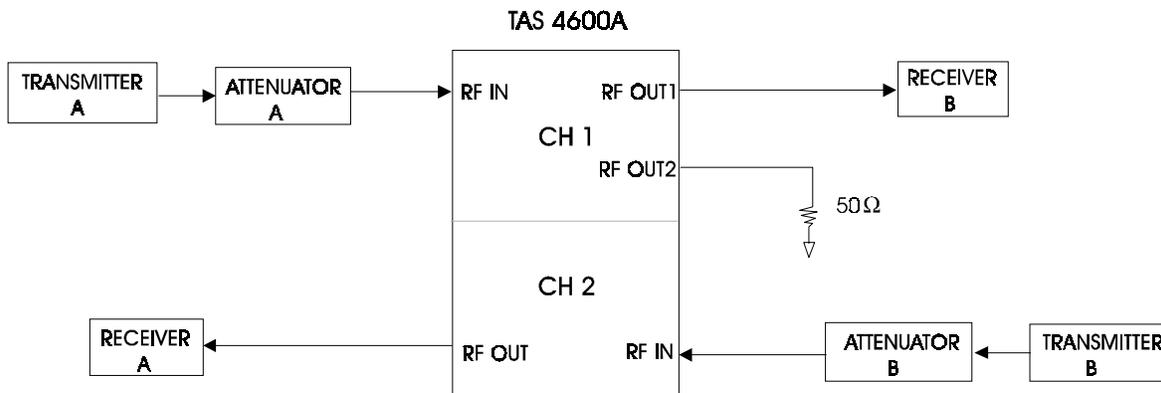


**Figure 1-7.  Duplex Channel Configuration**

**Signal Interconnect:**

1.  Install a cable from the antenna jack of RF transmitter A to the input of a 50 dB RF attenuator A.

    The attenuator is required if the transmit power is greater than the specified input signal level range of the 4600A (-10 dBm is the nominal;  see technical specifications for limits). The loss required by the RF attenuator depends on the transmitter's output power.  A 6 watt (38 dBm) transmitter with a 50 dB attenuator would present an input power of -12 dBm (38 dBm - 50 dB).

2.  Install a cable from the output of the RF attenuator A to the N type connector on the front panel of the TAS 4600A labeled "CHANNEL 1 RF IN".

3.  Repeat steps 1 and 2 above for transmitter B, attenuator B and channel 2 of the TAS 4600A.

4.  Install a cable from the N type connector on the front panel of the TAS 4600A labeled "CHANNEL 1 RF OUT" to the input of the RF receiver B.

5.  Repeat step 4 above for the "CHANNEL 2 RF OUT" of the TAS 4600A and RF receiver A.

**Parameter Settings:**

6. Basic installation is complete once the equipment has been setup as described in steps 1 to 5 above. You are now ready to set the parameters of the TAS 4600A to the values that are needed to conduct the test.

| Relevant Parameters | Manual Sections |
|---|---|
| C/N Ratio | 2.5.5 |
| C/I Ratio | 2.5.10 |
| Carrier Frequency | 2.5.3 |
| Carrier Output Level | 2.5.4 |
| Receiver Bandwidth | 2.5.6 |
| Status of Interference Source | 2.4.3 |
| Interference Frequency (Internal CW Option only) | 2.4.4 |
| Impairment Status | 2.5.2 |
| Number of Measurement Averages | 2.5.15 |

## 1.3.6. Two Branch Diversity Test Setup

A two channel TAS 4600A permits testing of dual diversity receivers in which a transmitter communicates with branch 1 of the diversity receiver through Channel 1 and branch 2 of the diversity receiver through Channel 2 of the TAS 4600A. This setup is illustrated in Figure 1-8 and typically requires the following:
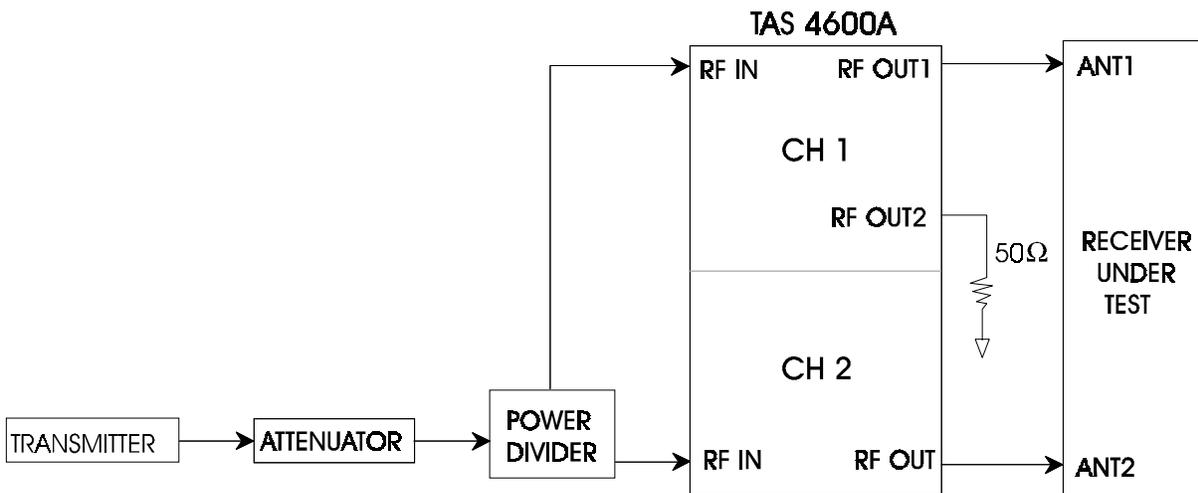


**Figure 1-8.  Two Branch Diversity Channel Configuration**

**Interconnect of the RF Transmit and Receive Signals**

1.  Install a cable from the antenna jack of the RF transmitter to the input of a 50 dB RF attenuator.

> **NOTE:** An attenuator is required if the transmit power is greater than the specified input signal level range of the 4600A (-10 dBm is the nominal;  see technical specifications for limits). The loss required by the RF attenuator depends on the transmitter's output power.  A 6 watt (38 dBm) transmitter with a 50 dB attenuator would present the power splitter with -12 dBm (38 dBm - 50 dB).

2.  Install a cable from the output of the attenuator to the input of a 50 ohm 2-way power splitter. The power splitter is needed to split the transmit signal to drive the two channel inputs of this TAS 4600A setup.

3.  Install a cable from one of the two splitter outputs to the N type connector on the front panel of the TAS 4600A labeled "CHANNEL 1 RF IN".  Install a cable from the second of the two splitter outputs to the N type connector on the front panel labeled "CHANNEL 2 RF IN" on the instrument.

4.  Install a cable from the output of the N type connector labeled "CHANNEL 1 RF OUT"  to the 1st input of the two branch diversity receiver.

5.  Repeat step 3 for the second 4600A channel output and the corresponding receiver input.

## 1.4. Feature Release History

The following information provides a summary of the feature releases of the 4600A that have occurred since the initial Version 1.00 release.

**Version 1.10**

- The internal dual CW interferer option was added.  The CW interferers cover 820-960 MHz and 1700-2000 MHz.

**Version 1.20**

- The Carrier Attenuator emulator mode was added.  This mode causes the instrument to act as a programmable attenuator for testing without impairments.

- The internal power meter zeroing algorithm was enhanced to improve performance at high frequencies.

**Version 1.30**

- The option to support carrier frequencies to 2.2 GHz was added.

- The Autoset Bypass option was added.

- The standby mode for the C/N, C/I, and Carrier Attenuator emulation was modified to pass the carrier signal through the instrument at a minimal insertion loss.  In previous releases the carrier path was left open in standby mode.

- The default setting for the electronically-controlled LCD contrast was changed from a value of 6 to 3.

- The capability to put the instrument in remote mode via the GPIB interface was added.

- The Power Level offset parameter was added.  This parameter allows the output level of the 4600A to be offset by a user specified level.

- The Impairment Status screen was moved from the Config/System submenu to the CH1 and CH2 submenus.

- ROM file support for IS-98-A and IS-97-A was added.

- Support for error codes E029, E030, E031 and E032 was added.

**Version 1.31**

- The Autoset algorithm was enhanced based on additional power-up measurements.

**Version 1.32**

- The firmware bug that caused the measured C/I ratio not to be updated in the CH2 submenu was corrected.

- The Chan1:Meas and Chan2:Meas commands were corrected to support C/I mode.

- The C/No setting for IS_98_fade recall file was modified.

- The label for the System Firmware field in the Summary screen was changed from CP to FW .

- Bypass option detection was added to the Summary submenu

**Version 1.33**

- The power-up noise density measurement algorithm was modified to more accurately detect the maximum noise density available to the user.

**Version 1.34**

- The firmware bug that caused intermittent power-up failures was corrected.

**Version 1.4**

- An additional internal CW interferer option that supports mobile applications is added.  This option offers a CW frequency range of 865-898 MHz and 1928-1992 MHz with enhanced phase noise performance.

- The Autoset algorithm is enhanced to increase the range over which the output level can be adjusted in OPERATING mode without falling back to STANDBY mode.

- The Autoset algorithm is enhanced to increase the accuracy of the reported C/N ratio that is measured after the Autoset is complete.

**Version 2.0**

- An internal duplexer option was added to facilitate mobile phone testing.

- A new front panel with new keys and a larger display was added.

- The Channel Bypass feature was incorporated.

- The CR/LF and ACK/NAK protocols were updated so that the 4600A goes into remote mode automatically as soon as a command is sent.

- Default remote protocol was changed to GPIB.

- The Autoset algorithm was modified to increase the maximum noise density available to the user.

- Speed of Autoset algorithm can be reduced by invoking the /MEAS:FAST/ remote command

**Version 2.10**

- Introduced TAS 4600AH which supports applications spanning 1.7 – 2.5 GHz frequency range.

**Version 2.20**

- Introduced TAS 4600AI which supports frequencies down to 800 MHz and each external interferer being routed to its own channel.

- The firmware bug which caused the carrier signal to drop in power if autoset was performed via a remote command on a 1 channel 4600 was corrected.

# 2.0. LOCAL OPERATION

## 2.1. Overview

The TAS 4600A Noise and Interference Emulator can be operated either locally from the instrument's front panel, or remotely using either the instrument's RS-232 or GPIB control interfaces. For remote control, a computer or terminal is required to pass commands to the TAS 4600A. Remote operation proves to be most effective when you need to perform automatic or repeated test scripts.

This section of the manual will describe the local operation of the TAS 4600A. Section 4.0. "*Remote Operation*" describes the TAS 4600A's remote command protocols and commands.

The TAS 4600A must either be in Remote Operation Mode or Local Operation Mode. It can never be in both modes at once. To toggle to Remote Operation Mode, simply set the unit to the desired remote protocol and begin sending commands. The letter 'R' will appear in the upper right corner of the LCD to indicate that the 4600A is in Remote Operation Mode. When in this mode, no parameters may be changed using the front panel keys, but browsing menus and viewing settings is still possible. To enter Local Operation Mode, press the LOCAL key. The 'R' indicator will disappear, signifying that the 4600A is no longer in Remote Operation Mode. Parameters can be adjusted via the front panel keys in LOCAL Operation Mode.

## 2.2. Getting Started

This section explains step by step how to perform local control of some of the basic features of the TAS 4600A. It is intended to familiarize the user with the local control through two examples. For more information on each menu and control key, refer to section 2.3. "*Menu Overview*".

The first example guides the user through a series of simple local control operations to perform a parameter file recall. The second example shows the user how to change certain system parameters and then how to save the parameter configuration as a user defined file for later use.

### 2.2.1. Recalling Predefined Test Configurations

The TAS 4600A provides a set of predefined test configurations which are stored in ROM and can be recalled as often as needed. For detailed information on these files see section 8.1 *Standard Test Profiles*. A predefined factory default file can be recalled. The default file sets the following parameters:

| DEFAULT VALUES | | |
|---|---|---|
| **Configuration** | | |
| Carrier to Noise Units | C/N | |
| Noise Generator Units | dBm | |
| Interference Source A Status | off | |
| Interference Source B Status | off | |
| CW Source A Frequency (MHz) | 880.90 | |
| CW Source B Frequency (MHz) | 881.70 | |
| **Channel** | **1** | **2** |
| Carrier Freq. (MHz) | 880.0 | 880.0 |
| Emulation Mode | C/N | C/N |
| Receiver Bandwidth (MHz) | 1.23 | 1.23 |
| Carrier to Noise Ratio (dB) | -1.0 | -1.0 |
| Bit Rate (bps) | 9600 | 9600 |
| $E_b/N_0$ Ratio (dB) | 20.1 | 20.1 |
| $C/N_0$ (dB) | 59.9 | 59.9 |
| C/I (dB) | 0 | 0 |
| Noise Power Density (dBm/Hz) | -100.0 | -100.0 |
| Output Level (dBm) | -50.0 | -50.0 |
| Power Level Offset (dB) | 0 | 0 |
| **Measure** | | |
| Monitor Point | CH1 | |
| # Averages | $1\ (2^0)$ | |
| Duty Cycle | 100% | |

By recalling any one of the predefined parameter configurations, the TAS 4600A can be configured for testing within seconds. RF communication devices can then be tested according to these specified standards. These predefined configurations can be easily recalled from the front panel by following the steps described below:

1.  Select the File menu by first pressing the **File** key on the front panel.  The File Recall submenu selection will appear on the last line of the front panel display as shown below:

```
FILE
Press Enter to Save/Recall file
SAVE FILE: file0↵
RESTORE FILE: file0↵
```

2.  Now move the blinking cursor to the RESTORE FILE selection by pressing the **Menu Navigation Right Arrow** key.

3.  Change the file name to the desired selection ("default" in this example) using the **Plus** or **Minus** key. You can experiment with changing the parameter value using these keys before proceeding to the next step.  In this example, "default" is chosen as the desired parameter configuration file.

```
FILE
Press Enter to Save/Recall file
SAVE FILE: file0↵
RESTORE FILE: default↵
```

4.  Execute the recall by pressing the **Enter** key. The front panel will display:

```
Recalling setup...
```

   Then:

```
Setup recalled - Esc to continue
```

Indicating a successful configuration recall from the default file.

If the TAS 4600A had not been equipped with the necessary hardware required for the desired configuration the following message would have been displayed:

```
Insufficient hardware configuration<ESC>
```

Whether successful or unsuccessful, when a file recall procedure is complete you will hear an audible beep.

5.  Press the **Escape** key to return to the File menu:

```
FILE
Press Enter to Save/Recall file
SAVE FILE: file0↵
RESTORE FILE: default↵
```

The TAS 4600A is now configured with the TAS defined default parameter values.

## 2.2.2. Defining and Saving Custom Test Configurations

In addition to predefined parameter configuration files, the TAS 4600A can save up to five (file 0 to file 4) user defined configurations. These user defined (SAVE) configuration files can also be recalled in the same manner as described in section 2.2.1, "*Recalling Predefined Test Setups*".

Defining a custom test setup can easily be done by first recalling the predefined configuration that is most similar to the desired setup, and then modifying those parameters that are different from the desired configuration.

After all the modifications have been made, the existing setup can be saved to one of the user files: file0, file1, file2, file3, or file4. This modified setup can then be recalled as described in section 2.2.1.

> **WARNING:** Any previous configuration in the user-defined file will be overwritten when the save operation is executed. The following is an example of defining and saving a user defined parameter configuration that is based on the factory default configuration:

1.  Recall the "**default**" configuration using the method described in the previous section, "*Recalling Predefined Test Configurations*."

2.  Select the Channel 1 Carrier Frequency Menu by first pressing the **Channel 1** key and then selecting the "**carrier-to-noise**" mode using the **Plus** and **Minus** keys.  Descend into the Carrier-to-Noise sub-menu by pressing the **ENTER** key.  Once this menu is displayed, use the **Menu Navigation Right, Left, Up** and **Down Arrow** keys to position the blinking cursor on the Carrier Frequency field (CARRIER:).

```
CH1 CARRIER-TO-NOISE
CARRIER:880.0MHz              OUTLVL:-40.00dBm
C/N: -1.0dB               MEASURED:     dB
IMPAIRMENTS: on        RECEIVER BW:  1.23 MHz
```

3.  Using the **Cursor Navigation Left Arrow** position the cursor under the "tens" of megahertz position in this field.

```
CH1 CARRIER-TO-NOISE
CARRIER:880.0MHz              OUTLVL:-40.00dBm
C/N: -1.0dB               MEASURED:     dB
IMPAIRMENTS: on        RECEIVER BW:  1.23 MHz
```

4.  Change the Carrier Frequency parameter to 860.0 MHz by pressing the **Minus** key twice:

```
CH1 CARRIER-TO-NOISE
CARRIER:860.0MHz              OUTLVL:-40.00dBm
C/N: -1.0dB               MEASURED:     dB
IMPAIRMENTS: on        RECEIVER BW:  1.23 MHz
```

5.  To save this new custom configuration to a user file, first select the File menu by pressing the **FILE** key.  The File Save submenu selection will appear on the third line from the top of the display as shown below:

```
FILE
Press Enter to Save/Recall file
SAVE FILE: file0↵
RESTORE FILE: file0↵
```

6.  If this field is not already selected, move the blinking cursor to the File Save submenu using the **Menu Navigation Up** and **Down Arrow** keys.

7.  Select the user file into which you want to save the current configuration by using the **Plus** or **Minus** keys. Remember that the previous configuration of the file will be overwritten. For this example, the configuration will be saved to file 1:

```
FILE
Press Enter to Save/Recall file
SAVE FILE: file1↵
RESTORE FILE: file0↵
```

8.  Execute the save operation by pressing the **Enter** key. The front panel will now display:

```
Setup saved - Esc to continue
```

When a file save procedure is complete you will hear an audible beep.

9.  Press the **Escape** key again to return to the File menu:

```
FILE
Press Enter to Save/Recall file
SAVE FILE: file1↵
RESTORE FILE: file0↵
```

This custom parameter configuration is now saved to file 1 and can be recalled in the same manner as any other predefined configuration. The parameters that can be saved to and recalled from user files are listed below:

**System Configuration Parameters**

- Carrier to Noise Units

- Noise Generator Units

- Output level Offset Channel 1

- Output level Offset Channel 2

**Channel 1/Channel 2 Parameters**

- Carrier Frequency
- Emulation Mode
- Receiver Bandwidth
- Carrier to Noise Ratio
- Bit Rate
- $E_b/N_0$ Ratio
- $C/N_0$ Ratio
- C/I Ratio
- Noise Output Power Density
- Output Power Level
- Interference Source A Status
- Interference Source B Status
- CW Source A Frequency
- CW Source B Frequency
- Bypass Status

**Measurement Parameters**

- Measurement Source
- # Averages
- Duty Cycle

**WARNING:** The Remote Protocol parameters are not saved as part of a user-defined file.

## 2.3. Menu Overview

The TAS 4600A provides a convenient and easy to use hierarchical menu structure that gives easy access to all of its functions. This section will give you instructions on navigating through the TAS 4600A menu structure using the keys on the front panel. You will also find specific information about the different menus which appear in the TAS 4600A LCD display.

### 2.3.1. Menu Summary

There are five menu tree groups in the TAS 4600A; CHANNEL 1, CHANNEL 2, MEASURE, CONFIG, and FILE.  Each of these menus is represented by a key on the instrument's front panel.  For example, to access the CONFIG menu tree, press the CONFIG key.  These menu trees organize the TAS 4600A's functionality so that you can find the instrument's features easily. Once you become familiar with the TAS 4600A's menu structure, you will find it easy to use.

### CHANNEL 1 Main Menu

The **CHANNEL 1** menu group controls the simulated unidirectional RF impairment channel.  This menu group allows I/O parameters (carrier frequency, output level) as well as RF channel parameters (impairment mode, interference ratio) to be viewed and controlled.  The menu screens contained in the **CHANNEL 1** menu group are shown below:

*CHANNEL1\CARRIER TO NOISE Submenu*

```
CHANNEL1
MODE: carrier-to-noise↵


```

For C/N UNITS=C/N

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz       OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

For C/N UNITS=$C/N_0$

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz       OUTLVL: -50.00dBm
C/No: 59.9dBHz         MEASURED:  60.0dBHz
IMPAIRMENTS: on
```

For C/N UNITS=$E_b/N_0$

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz       OUTLVL: -50.00dBm
Eb/No: 20.1dB          MEASURED: 20.0dB
IMPAIRMENTS: on    BIT RATE:     9600 bps
```

*CHANNEL1\CARRIER TO INTERFERER Submenu*

```
CHANNEL1
MODE: carrier-to-interferer↵


```

```
CHANNEL1 CARRIER-TO-INTERF              ⇩
CARRIER: 880.0MHz        OUTLVL: -40.00 dBm
C/I: -1.0dB             MEASURED:  -1.1 dB
IMPAIRMENTS: on
```

```
CHANNEL1 CARRIER-TO-INTERF              ⇧
INTERFERENCE SRC A: off      SRC B: off
CW FREQ A: 880.90MHz     FREQ B: 881.70MHz

```

*CHANNEL1\NOISE GENERATOR Submenu*

```
CHANNEL1
MODE: noise generator↵


```

For NOISE UNITS = dBm

```
CHANNEL1 NOISE GENERATOR
CARRIER: 880.0 MHz    NSLVL: -40.0 dBm
RECEIVER BW:  1.23 MHz
IMPAIRMENTS: on
```

For NOISE UNITS = dBm/Hz

```
CHANNEL1 NOISE GENERATOR
CARRIER: 880.0 MHz    NSLVL:-100.0 dBm/Hz
IMPAIRMENTS: on

```

*CHANNEL1\INTERFERENCE GENERATOR Submenu*

```
CHANNEL1
MODE: interference generator↵


```

```
CHANNEL1 INTERF GENERATOR            ⇩
BAND: 800-1000MHz      OUTLVL: -50.00dBm
IMPAIRMENTS: on

```

```
CHANNEL1 INTERF GENERATOR            ⇧
INTERFERENCE SRC A: off      SRC B: off
CW FREQ A: 880.90MHz     FREQ B: 881.70MHz

```

*CHANNEL1\CARRIER ATTENUATOR Submenu*

```
CHANNEL1
MODE: carrier attenuator↵


```

```
CHANNEL1 CARRIER ATTENUATOR
CARRIER: 880.0MHz         OUTLVL: -40.00dBm


```

**CHANNEL 2 Main Menu**

The **CHANNEL 2** menu group controls the simulated unidirectional RF impairment channel.  This menu group allows I/O parameters (carrier frequency, output level) as well as RF channel parameters (impairment mode, interference ratio) to be viewed and controlled.  The menu screens contained in the **CHANNEL 2** menu group are shown below:

*CHANNEL2\CARRIER TO NOISE Submenu*

```
CHANNEL2
MODE: carrier-to-noise↵

```

For C/N UNITS=C/N

```
CHANNEL2 CARRIER-TO-NOISE
CARRIER: 860.0MHz      OUTLVL: -50.00dBm
C/N: -1.0dB           MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

For C/N UNITS=$C/N_0$

```
CHANNEL2 CARRIER-TO-NOISE
CARRIER: 860.0MHz      OUTLVL: -50.00dBm
C/No: 59.9dBHz        MEASURED:  60.0dBHz
IMPAIRMENTS: on
```

For C/N UNITS=$E_b/N_0$

```
CHANNEL2 CARRIER-TO-NOISE
CARRIER: 860.0MHz      OUTLVL: -50.00dBm
Eb/No: 20.1dB          MEASURED: 20.0dB
IMPAIRMENTS: on    BIT RATE:      9600 bps
```

*CHANNEL2\CARRIER TO INTERFERER Submenu*

```
CHANNEL2
MODE: carrier-to-interferer↵
```

```
CHANNEL2 CARRIER-TO-INTERF                    ⇩
CARRIER: 880.0MHz          OUTLVL: -40.00 dBm
C/I: -1.0dB                MEASURED:  -1.1 dB
IMPAIRMENTS: on
```

```
CHANNEL2 CARRIER-TO-INTERF                    ⇧
INTERFERENCE SRC A: off         SRC B: off
CW FREQ A: 880.90MHz         FREQ B: 881.70MHz
```

*CHANNEL2\NOISE GENERATOR Submenu*

```
CHANNEL2
MODE: noise generator↵
```

For NOISE UNITS = dBm

```
CHANNEL2 NOISE GENERATOR
CARRIER: 880.0 MHz    NSLVL: -40.0 dBm
RECEIVER BW:  1.23 MHz
IMPAIRMENTS: on
```

For NOISE UNITS = dBm/Hz

```
CHANNEL2 NOISE GENERATOR
CARRIER: 880.0 MHz    NSLVL:-100.0 dBm/Hz
IMPAIRMENTS: on
```

*CHANNEL2\INTERFERENCE GENERATOR Submenu*

```
CHANNEL2
MODE: interference generator↵
```

```
CHANNEL2 INTERF GENERATOR                    ⇩
BAND: 800-1000MHz        OUTLVL: -50.00dBm
IMPAIRMENTS: on
```

```
CHANNEL2 INTERF GENERATOR                    ⇧
INTERFERENCE SRC A: off        SRC B: off
CW FREQ A: 880.90MHz       FREQ B: 881.70MHz
```

*CHANNEL2\CARRIER ATTENUATOR Submenu*

```
CHANNEL2
MODE: carrier attenuator↵
```

```
CHANNEL2 CARRIER ATTENUATOR
CARRIER: 880.0MHz         OUTLVL: -40.00dBm
```

## MEASURE Main Menu

The **MEASURE** menu group controls the instrument's integrated RF power meter. The measure menu group is as follows:

```
MEASURE                                            ⇩
MONITOR:ch1 input        MEASURED: -17.6 dBm
AVERAGES: 1              DUTY CYCLE: 100%

```

```
MEASURE                                            ⇕
Press enter to zero power meter.↵


```

## CONFIG Main Menu

The **CONFIG** menu group allows the configuration of the remote control protocol, displays the instrument's software version and diagnostic status, and selects the carrier-to-noise and noise generator units displayed in the Channel submenus.  The CONFIG menu group arrangement is as follows:

```
CONFIG                                            ⇩
Remote Protocol: gpib↵      SUMMARY↵
OUTLVL OFFSET CH1: 0.0 dB   CH2: 0.0 dB
LCD CONTRAST: 7
```

```
CONFIG                                            ⇧
CARRIER-TO-NOISE UNITS: Eb/No
NOISE GENERATOR UNITS: dBm/Hz
```

*CONFIG\CRLF Remote Protocol Submenu*

```
CONFIG SUBMENU
CRLF REMOTE PROTOCOL
BAUD RATE: 4800
DATA: 7      PARITY: odd        STOP: 1
```

*CONFIG\GPIB Remote Protocol Submenu*

```
CONFIG SUBMENU
GPIG REMOTE PROTOCOL
ADDRESS:    1
```

*CONFIG\ACKNAK Remote Protocol Submenu*

```
CONFIG SUBMENU
ACKNAK REMOTE PROTOCOL
BAUD RATE: 4800    ADDRESS: 1
Data: 7        PARITY: odd        STOP: 1
```

*CONFIG\SUMMARY Submenu*

```
CONFIG SUMMARY                                  ⇩
SYSTEM SUMMARY
STATUS:ok
MODEL:4600A    FW VER: 2.00
```

```
CONFIG SUMMARY                                  ⇕
SYSTEM SUMMARY
CH1 NOISE FILTER #1:800-1000 MHz
CH1 NOISE FILTER #2:1700-2000 MHz
```

```
CONFIG SUMMARY                                  ⇕
SYSTEM SUMMARY
CH2 NOISE FILTER #1:800-1000 MHz
CH2 NOISE FILTER #2:1700-2000 MHz
```

```
CONFIG SUMMARY                                  ⇕
SYSTEM SUMMARY
CH1 ATTENUATOR: extended, 0.25dB res.
CH2 ATTENUATOR: extended, 0.25dB res.
```

```
CONFIG SUMMARY                                  ⇕
SYSTEM SUMMARY
CW TYPE: 0.8-1.0,1.7-2.0 GHz, 10kHz res.
CARRIER BYPASS: installed
```

```
CONFIG SUMMARY                                  ⇧
SYSTEM SUMMARY
DUPLEXER OPTION: installed
POWER METER VERSION: 2.0
```

## FILE Main Menu

The **FILE** menu group allows you to load both user and TAS defined parameter profiles and to save user-defined parameter configurations. The FILE menu group is as follows.

```
FILE
Press Enter to Save/Recall file
SAVE FILE: file0↵
RESTORE FILE: file0↵
```

## 2.3.2. Control Key Summary

This section describes the set of keys used to navigate through the TAS 4600A menus.

**MENU GROUP SELECT KEYS**
The menu tree select keys are: CHANNEL 1, CHANNEL 2, MEASURE, FILE and CONFIG.  Pressing any one of these five keys will select that menu group and return to the menu screen previously displayed the last time this menu tree was active. By pressing a menu tree key for the currently selected submenu group, you can return back to the top of the menu tree.

To illustrate this function, when the CONFIG key is pressed while in one of the remote protocol submenus, as in the example below, you will exit the submenu and the front panel will display the high level menu screen.

Current screen...

```
CONFIG SUBMENU
GPIG REMOTE PROTOCOL
ADDRESS:    1

```

Press CONFIG key...

```
CONFIG                                            ⇩
Remote Protocol: gpib↵      SUMMARY↵
OUTLVL OFFSET CH1: 0.0 dB   CH2: 0.0 dB
LCD CONTRAST: 7
```

Menu trees are configured in a hierarchical nature, each with associated levels of submenus.  To indicate a submenu is present, a carriage return symbol is displayed at the right side of a menu parameter.  The first (and sometimes second) line of the LCD displays a heading indicating what part of the menu tree is being shown.

A screen above/below prompt is also used to indicate the presence of additional screens above and/or below the current screen in the selected menu.  This directional arrow character is displayed in the last position on the top line of the LCD.  An up arrow (⇧) indicates that there is a screen above the current screen, accessible using the **Menu Navigation Up Arrow** key.  A down arrow (⇩) indicates that there is a screen below the current screen, accessible using the **Menu Navigation Down Arrow** key.  An up/down arrow (⇕) indicates that there are screens both above and below the current screen.

**MENU NAVIGATION UP & DOWN ARROW KEYS**
To move among lines on a screen and to move between screens of the same menu, the **Menu Navigation Up** and **Down Arrow** keys are used. They are located together with the **Menu Navigation Left** and **Right Arrow** keys as a group within the SELECT/EDIT block on the front panel.

As an example, suppose the user is on the REMOTE PROTOCOL field of the Config menu.  If the **Menu Navigation Down Arrow** key is pressed, the cursor will move to the OUTLVL OFFSET CH1 field.  Pressing that key two more times changes the screen to the second config screen, showing the options for units.  In the example below, note how the screen above/below prompt changes to indicate that there are screens in different locations relative to the current screen.

Current screen...

```
CONFIG                                          ⇩
Remote Protocol: gpib↵      SUMMARY↵
OUTLVL OFFSET CH1: 0.0 dB   CH2: 0.0 dB
LCD CONTRAST: 7
```

Press **Menu Navigation Down Arrow** key...

```
CONFIG                                          ⇩
Remote Protocol: gpib↵      SUMMARY↵
OUTLVL OFFSET CH1: 0.0 dB   CH2: 0.0 dB
LCD CONTRAST: 7
```

Press **Menu Navigation Down Arrow** key twice more...

```
CONFIG                                          ⇧
CARRIER-TO-NOISE UNITS: Eb/No
NOISE GENERATOR UNITS: dBm/Hz
```

**MENU NAVIGATION LEFT & RIGHT ARROW KEYS**
The **Menu Navigation Left** and **Right Arrow** Keys move the cursor between parameter fields of the same menu screen. They are located together with the **Menu Navigation Up** and **Down Arrow** keys as a within the SELECT/EDIT block the front panel display. The following example illustrates how to change the active field from CARRIER Frequency to OUTput LeVeL while on the Channel 1 Carrier-to-Noise submenu.

Current field...

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz      OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on   RECEIVER BW:  1.23 MHz
```

Press **Menu Navigation Right Arrow** key...

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz       OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on   RECEIVER BW:  1.23 MHz
```

**ENTER & ESCAPE KEYS**
The Enter and Escape keys have two main functions.  Their first function is to allow entry and exit from submenus.  When the blinking cursor is positioned on this carriage return symbol (↵), the associated submenu can be accessed by pressing the Enter key as in the example shown below.

Current screen...

```
CHANNEL1
MODE: carrier-to-noise↵

```

Press Enter key...

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz        OUTLVL: -50.00dBm
C/N: -1.0dB              MEASURED:  -1.1dB
IMPAIRMENTS: on   RECEIVER BW:  1.23 MHz
```

Pressing the Escape key exits the submenu.  An example is shown below.

Current screen...

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz        OUTLVL: -50.00dBm
C/N: -1.0dB              MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

Press Escape key...

```
CHANNEL1
MODE: carrier-to-noise⏎
```

The secondary function of the Enter and Escape keys is to execute instrument functions and clear errors.  In screens that allow the user to execute a particular action, the display indicates the instrument function performed by pressing the Enter key as shown in the example below.

```
FILE
Press Enter to Save/Recall file
SAVE FILE: file0⏎
RESTORE FILE: file0⏎
```

If an error occurs after executing an instrument function, the Escape key will clear the error screen.  After being prompted of the error shown in the screen below, pressing the Escape key clears the error condition and returns control to the previous screen.

```
Output power out of range.
Press Esc to continue
```

**CURSOR  LEFT & RIGHT ARROW KEYS**
The Cursor  Left and Right Arrow Keys move the cursor between digits within a parameter field.  The following example shows how to move from the hundred's to the ten's of megahertz digit.

Current digit...

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz       OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

Press Cursor Right Arrow key...

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz       OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

**PLUS AND MINUS KEYS**

The **Plus** and **Minus** keys are used to modify the value of the parameter field that is currently active. The **Plus** key increments the value of the field while the **Minus** key decrements the value of the field.  An example is shown below.

Current value...

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 880.0MHz       OUTLVL: -50.00dBm
C/N: -1.0dB           MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

Press **Plus** key...

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 890.0MHz       OUTLVL: -50.00dBm
C/N: -1.0dB           MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

Use the **Plus** and **Minus** keys to scroll through lists of keywords in fields such as SAVE FILE, MODE, and CARIER-TO-NOISE UNITS.

## 2.4. Setting System Configuration Parameters

This section contains information on system configuration parameters. It is assumed that the user is familiar with the basic local operations of the TAS 4600A. If you are not familiar with the local control of the TAS 4600A, please read sections 2.2. "*Getting Started*" and 2.3. "*Menu Overview*" before referring to this section.

The menu location, definition and range of the system configuration parameters are listed in the following sections.

### 2.4.1. Selecting the Noise Generator Units

When the 4600A is configured for Noise Generator mode, the user must select the desired units for setting and displaying the output noise level.  This selection will affect the available parameters in the Channel 1 and Channel 2 Menu Tree when Noise Generator mode is selected.   Although the actual noise output levels are specified independently in the Channel 1 and Channel 2 menus, the choice of units in this menu will apply globally to both Channel 1 and Channel 2.

If the units are configured for **dBm**, the user value specified will represent the total noise power (N) in the user-specified receiver bandwidth.

If the units are configured for **dBm/Hz**, the user value specified will represent the output noise density (No).

The **Plus** and **Minus** keys are used to select the desired noise generator units.

```
CONFIG                                         ⇧
CARRIER-TO-NOISE UNITS: Eb/No
NOISE GENERATOR UNITS: dBm/Hz
```

---

**NOISE GENERATOR UNITS**

**Definition**
Sets the units that apply to the noise generator mode of the TAS 4600A.

**Value Range**
dBm, dBm/Hz

### 2.4.2. Selecting the Carrier-to-Noise Units

When the 4600A is configured for Carrier-to-Noise mode, the user must select the desired units for setting and displaying the carrier-to-noise ratio.  This selection will affect the available parameters in the Channel 1 and Channel 2 Menu Tree when carrier-to-noise mode is selected.  Although the actual carrier-to-noise ratios are specified independently in the Channel 1 and Channel 2 menus, the choice of units in this menu will apply globally to both Channel 1 and Channel 2.

If the units are configured for **C/N**, the user value specified will represent the ratio of the total carrier power (C), to the total noise power (N) in the user-specified receiver bandwidth.

If the units are configured for **C/No**, the user value specified will represent the ratio of the total carrier power (C), to the noise density (No).  The units for noise density (No) are dBm/Hz.

If the units are configured for $E_b/N_o$, the user value specified will represent the ratio of the energy per bit in the carrier ($E_b$), to the noise density (No).  The energy per bit ($E_b$) in the carrier is derived by dividing the measured carrier power by the user specified data rate.  The units for noise density (No) are dBm/Hz.

The **Plus** and **Minus** keys are used to select the desired carrier-to-noise units.

```
CONFIG                                              ⇧
CARRIER-TO-NOISE UNITS: Eb/No
NOISE GENERATOR UNITS: dBm/Hz
```

**CARRIER-TO-NOISE UNITS**

**Definition**
Sets the units that apply to the carrier-to-noise mode of the TAS 4600A.

**Value Range**
C/N, C/No, $E_b/N_o$

### 2.4.3. Selecting the Status of Interference Source A and Interference Source B

When the 4600A is configured for Carrier to Interference mode, the user must set the status of the two available interference sources.  Interference Source A and B are summed internally by the 4600A and can be applied to Channel 1, Channel 2, or to both channels simultaneously.

Interference Source A and Source B can be independently configured to be derived from either external inputs (SMA connectors on the 4600A rear panel) or an internal dual CW interference generator (optional).  Interference Source A and B are summed together as shown in Figure 2-1.  The composite signal is split and can be applied to both Channel 1 and Channel 2.
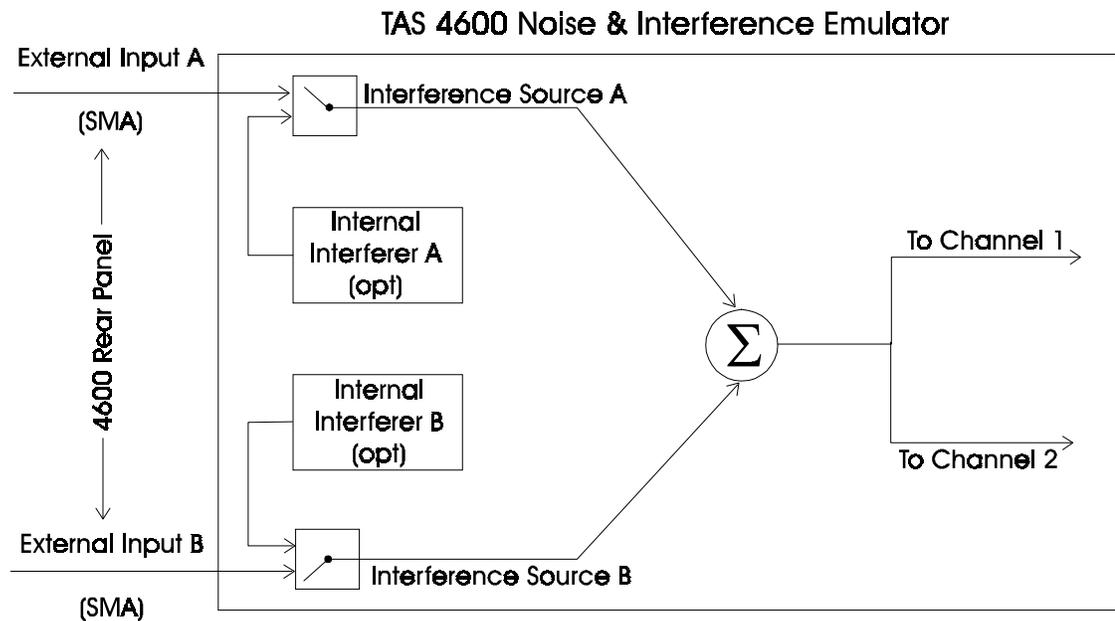


Figure 2-1.  Additive Interference Module Block Diagram.

When not in use the status of the interference sources should be set to OFF. When set to OFF, an external 50 $\Omega$ termination is not required on the external interference SMA connectors.

Units not equipped with the dual internal synthesizer module will not allow users to select INTERNAL. However, EXTERNAL and OFF are still valid.

The **Plus** and **Minus** keys are used to select the status of the two independent interference sources.

These parameters are located under four separate menus depending on the mode selected, but they all refer to the same interference sources:

```
CHANNEL1 CARRIER-TO-INTERF                  ⇧
INTERFERENCE SRC A: off        SRC B: off
CW FREQ A: 880.90MHz      FREQ B: 881.70MHz
```

```
CHANNEL1 INTERF GENERATOR                   ⇧
INTERFERENCE SRC A: off        SRC B: off
CW FREQ A: 880.90MHz      FREQ B: 881.70MHz
```

```
CHANNEL2 CARRIER-TO-INTERF                  ⇧
INTERFERENCE SRC A: off        SRC B: off
CW FREQ A: 880.90MHz      FREQ B: 881.70MHz
```

```
CHANNEL2 INTERF GENERATOR                   ⇧
INTERFERENCE SRC A: off        SRC B: off
CW FREQ A: 880.90MHz      FREQ B: 881.70MHz
```

## INTERFERENCE SOURCE A & B STATUS

**Definition**
Sets the status of Interference Source A and Interference Source B in the TAS 4600A.  These sources are applicable for Carrier-to-Interference Mode and Interference Generator Mode.

**Value Range**
off, intern(al), extern(al)

## 2.4.4. Setting the Frequency of CW Source A and CW Source B

When the 4600A is equipped with the dual internal synthesizer option the user can independently set the frequency of the two available CW sources.  Either one or both CW sources must be selected as the active Interference Source to be in use. Interference Source A and B are summed internally by the 4600A and can be applied to Channel 1, Channel 2, or to both channels simultaneously.  See Section 2.4.3. "*Selecting the Status of Interference Source A and Interference Source B*" for further details on selecting the internal CW sources as the active interference sources. If the 4600 is not equipped with the dual internal synthesizer module, the string "------" will be printed next to the text "CW FREQ A" and "CW FREQ B".

The **Plus** and **Minus** keys are used to set the frequency of the two independent internal CW sources.  These parameters are located under four separate menus depending on the mode selected, but they all refer to the same interferers:

```
CHANNEL1 CARRIER-TO-INTERF                      ⇧
INTERFERENCE SRC A: off        SRC B: off
CW FREQ A: 880.90MHz        FREQ B: 881.70MHz
```

```
CHANNEL1 INTERF GENERATOR                       ⇧
INTERFERENCE SRC A: off        SRC B: off
CW FREQ A: 880.90MHz        FREQ B: 881.70MHz
```

```
CHANNEL2 CARRIER-TO-INTERF                      ⇧
INTERFERENCE SRC A: off        SRC B: off
CW FREQ A: 880.90MHz        FREQ B: 881.70MHz
```

```
CHANNEL2 INTERF GENERATOR                       ⇧
INTERFERENCE SRC A: off        SRC B: off
CW FREQ A: 880.90MHz        FREQ B: 881.70MHz
```

**CW SOURCE A & B FREQUENCY**

**Definition**
Sets the frequency of the internal CW  Source A and Source B in the TAS 4600A. These sources are applicable when the internal sources are selected in either Carrier-to-Interference Mode or Interference Generator Mode.

**Value Range**
T4600-DINT option:  800.00 to 1000.00 MHz, 1700.00 to 2000.00 MHz
T4600-DINTM option:  865.00 to 898.00 MHz, 1928.00 to 1992.00 MHz

### 2.4.5. Setting the Output Level Offset Parameter

The TAS 4600A can be configured for an output carrier signal level which is offset by a user-programmed value.  This can be useful when the user wishes to adjust the 4600A output level to match an external power reference instead of the power reference used by the instrument.

As an example application of this feature, suppose the user wishes to adjust the 4600A carrier output level to match an external power reference.  With the 4600A in operating mode, a difference of 1.0 dB is measured between the value set with the Carrier Output Level parameter in the 4600A and the external reference.  In this example case, the 4600A Carrier Output Level parameter is set to -45.00 dBm and the external power reference measures -46.0 dBm.  That is, the 4600A level is 1.0 dB above the level indicated by the external reference.  The user can compensate for this difference by setting the Output Level Offset parameter in the 4600A to +1.0 dB.  With the Carrier Output Level set to -45.0 dBm and the Output Level offset parameter set to 1.0 dB, a subsequent AUTOSET will cause the 4600A to output a level of (-45.00 dBm + 1.0 dB) = -44.0 dBm relative to the 4600A's internal power reference.  When measured with the same external power reference an output level of -45.0 dBm will be achieved.

> **NOTE:** This parameter applies only to the Carrier Output Level in Carrier-to-Noise, Carrier-to-Interference, and Carrier Attenuator Modes.  In Interference Generator Mode this offset applies to the output level of the interference.  The Output Level Offset parameter has no effect on the output level of noise in Noise Generator mode nor does it affect the programmed ratio of C/N or C/I.

The **Plus** and **Minus** keys are used to set the value of the Output Level Offset on each channel independently.

```
CONFIG                                           ⇩
Remote Protocol: gpib↵       SUMMARY↵
OUTLVL OFFSET CH1: 0.0 dB   CH2: 0.0 dB
LCD CONTRAST: 7
```

**OUTPUT LEVEL OFFSET**

**Definition**
Sets the desired level offset from the programmed Output Level (PLVL) parameter.

**Value Range**
-2.5 to +2.5 dB

### 2.4.6. Viewing the System Status

The TAS 4600A Summary submenu in the CONFIG Menu Tree contains system status information such as the instrument's model number, control processor firmware version, and current operating status.  Information pertaining to which RF modules are present in the system is also given.  The screens found in the Summary submenu are "read-only" and do not contain any user programmable parameters.

```
CONFIG SUMMARY                                    ⇓
SYSTEM SUMMARY
STATUS:ok
MODEL:4600A    FW VER: 2.00
```

```
CONFIG SUMMARY                                    ⇕
SYSTEM SUMMARY
CH1 NOISE FILTER #1:800-1000 MHz
CH1 NOISE FILTER #2:1700-2000 MHz
```

```
CONFIG SUMMARY                                    ⇕
SYSTEM SUMMARY
CH2 NOISE FILTER #1:800-1000 MHz
CH2 NOISE FILTER #2:1700-2000 MHz
```

```
CONFIG SUMMARY                                    ⇕
SYSTEM SUMMARY
CH1 ATTENUATOR: extended, 0.25dB res.
CH2 ATTENUATOR: extended, 0.25dB res.
```

```
CONFIG SUMMARY                                    ⇕
SYSTEM SUMMARY
CW TYPE: 0.8-1.0,1.7-2.0 GHz, 10kHz res.
CARRIER BYPASS: installed
```

```
CONFIG SUMMARY                                    ⇑
SYSTEM SUMMARY
DUPLEXER OPTION: installed
POWER METER VERSION: 2.0
```

### 2.4.7. Setting the Contrast Parameter for the LCD Display

The user can vary the contrast of the LCD on the front panel of the TAS 4600A by adjusting the LCD CONTRAST parameter in the Display submenu of the CONFIG Menu Tree.  Increasing the index for this parameter increases the amount of contrast.

```
CONFIG                                          ⇩
Remote Protocol: gpib↵      SUMMARY↵
OUTLVL OFFSET CH1: 0.0 dB  CH2: 0.0 dB
LCD CONTRAST: 7
```

**LCD CONTRAST**

**Definition**
Adjusts the amount of contrast for the LCD on the front panel of the TAS 4600A.

**Value Range**
0-10

## 2.5. Configuring the System for Receiver Performance Testing

This section contains information on setting up the 4600A for performance testing. It is assumed that the user is familiar with the basic local operations of the TAS 4600A. If you are not familiar with the local control of the TAS 4600A, please read sections 2.2. "*Getting Started*" and 2.3. "*Menu Overview*" before referring to this section.

---

**NOTE:** Before the user can begin performance testing using the TAS 4600A, an AUTOSET operation must be performed.  The purpose of the AUTOSET is to allow the 4600A to set the appropriate level of noise or interference relative to the measured carrier power and the impairment ratios specified by the user.  Prior to performing an AUTOSET operation, the instrument should be configured for the desired test conditions.  Press the Channel 1 or Channel 2 within the AUTOSET group on the front panel to perform an AUTOSET.  Once the AUTOSET is completed, the 4600A is in operating mode and the AUTOSET LED for the operating channel will be illuminated.

---

The following section is intended to guide the user through a typical sequence for operating the TAS 4600A.

### 2.5.1. Setting the Channel Impairment Mode

The most common channel impairment mode of the TAS 4600A configures the instrument to take in a user-supplied carrier signal and combine it internally with a pre-determined level of noise.  For this configuration, the **carrier-to-noise** mode should be selected.  When programmed for this mode, the units describing the carrier-to-noise ratio must be specified.  Refer to section 2.4.2 *"Selecting the Carrier-to-Noise Units"* for additional details.

For evaluating the ability of a receiver to perform in the presence of another type of interferer, the **carrier-to-interference** mode should be selected.  When in this mode the 4600A will accept a user-supplied carrier signal and combine it internally with either a user-supplied external interferer or an internally generated CW interference signal at a user-defined C/I ratio.

The unit can also be configured to function in an impairment generator mode.  In both the **noise generator** mode and **interference generator** mode, the 4600A acts as a programmable impairment source and does not accept a carrier signal.  Interference generator mode is not available for units without an internal synthesizer module

In **carrier attenuator** mode, the 4600A can act as a calibrated attenuator of the input carrier signal.  This allows the user to precisely control the output level for the carrier signal.  No impairments are added to the carrier signal in this mode.

```
CHANNEL1
MODE: carrier-to-noise↵
```

```
CHANNEL2
MODE: carrier-to-interference↵
```

**Channel Impairment Mode**

**Definition**
Sets the channel impairment mode

**Value Range**
carrier-to-noise, carrier-to-interference, noise generator, interference generator, carrier attenuator

## 2.5.2. Selecting the Status of Impairments on Channel 1 and Channel 2

The user can independently enable or disable the impairments on Channel 1 and Channel 2 using the menu screens below.  Switching the impairment status "off" on a channel allows all impairments to be removed from the carrier signal in any emulation mode.  This feature proves useful when it is desirable to temporarily disable the impairments after an AUTOSET has been performed.  Toggling the status of the impairments will not cause the 4600A to leave the operating state.  If the disabled channel was in operating mode prior to disabling impairments on that channel the [NSE OFF] status prompt will be displayed in the upper right corner of the LCD.  The AUTOSET LEDs will remain illuminated.

```
CHANNEL1 CARRIER-TO-NOISE   [NSE OFF]
CARRIER: 860.0MHz      OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

The channel can be returned to [OPERATING] mode without the need for a new AUTOSET by re-enabling the channel impairments.

The **Plus** and **Minus** keys are used to select the status of the two independent impairment channels.

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz      OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

```
CHANNEL2 NOISE GENERATOR    [NSE OFF]
CARRIER: 880.0 MHz   NSLVL:-100.0 dBm/Hz
IMPAIRMENTS: on
```

### CH1 & CH2 IMPAIRMENTS STATUS

**Definition**
Independently sets the status of the Channel 1 and Channel 2 impairments.

**Value Range**
on, off

### 2.5.3. Setting the Carrier Frequency

The user must set the carrier frequency of the RF input signal for Channel 1 and Channel 2.  The CARRIER parameter is used by the TAS 4600A in determining the appropriate calibration factors used to achieve accurate impairment levels. Although the 4600A will function if set to a carrier frequency other than that of the input signal, the instrument's performance will be degraded.

> **NOTE:**  Changing the Carrier Frequency parameter while the unit is in operating mode will cause the unit to go to standby mode.  A new AUTOSET must be performed at the new selected frequency in order to return to the operation mode.

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 880.0MHz        OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

```
CHANNEL2 CARRIER-TO-NOISE
CARRIER: 860.0MHz        OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

**CARRIER**

**Definition**
Sets the carrier frequency for the selected RF channel.

**Value Range**
Depends on the specific RF options installed. See technical specifications for details.

### 2.5.4. Setting the Carrier Output Level

The TAS 4600A allows the user to specify a precise output level for the carrier signal.  A standard 4600A can provide a wide dynamic range of programmable insertion loss in the carrier channel path with 0.25 dB resolution. The choice of output level will affect the range of impairment ratios that can be attained.  For example, small output power levels will limit the upper end of the impairment ratios that can be supported.  Conversely, large output levels will restrict the lower end of impairment ratios that can be achieved.

The output level programmed refers to the carrier signal only.  When noise or interference has been added to the input signal, the composite output power that can be measured with a non-frequency selective power meter will be greater than the value displayed in the OUTLVL field.

An Output Power Level Offset can also be programmed.  See section 2.4.5 for details on setting this parameter.

---

**NOTE:**  Changing the Output Level parameter while the TAS 4600A is in the operating state may cause the system to go into the standby state.  The Output Level at which the change in state occurs will depend on the current Output level parameter selected, the current input power, and the current ratio.  A new AUTOSET must be performed at the new selected Output Level in order to return to the operating state.

---

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 880.0MHz      OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

```
CHANNEL2 CARRIER-TO-NOISE
CARRIER: 880.0MHz      OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

---

**OUTPUT LEVEL (PLVL )**

**Definition**
Sets the carrier signal output level for the RF channel selected.

**Value Range**
-5.00 to -120.00 dBm

### 2.5.5. Setting the Carrier-to-Noise Ratio (C/N)

When using the instrument in the carrier-to-noise impairment mode the user has a choice of three different units with which to program the ratio.  When the units selected are **C/N**, the ratio programmed will represent the relative difference between the carrier signal power and the total noise power present in the user-specified receiver bandwidth.  See Section 2.4.2, for selecting the carrier-to-noise units. Also, see Section 2.5.6 for instructions on programming the receiver bandwidth.

The carrier-to-noise ratio can be set over a large range with 0.1 dB resolution.  The range of ratios that can be supported is dependent on the carrier input level, the desired output level, and the programmed Receiver Bandwidth.

The menus below display the programmed carrier-to-noise ratio (**C/N**) and the currently measured ratio. The programmed ratio does not become valid until after an AUTOSET procedure is performed.  After a valid AUTOSET, the Channel 1 or Channel 2 AUTOSET LED will be illuminated, signifying an operating condition.

After an AUTOSET operation, the impairment level will be set according to the desired ratio and the current carrier output level.  This impairment level will remain constant until the ratio is changed or a parameter is modified which invalidates the AUTOSET.  While in operating mode, the current measured ratio is displayed in the field to the right of the programmed value.  Differences between the programmed ratio and the measured ratio are due to variations in the carrier input level.

Prior to an AUTOSET, the MEASURED field will appear blank.  The rate at which the MEASURED value changes is a function of the internal power meter averaging.  See section 2.5.15 for details on programming the averaging parameter for the internal power meter.

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 880.0MHz        OUTLVL: -50.00dBm
C/N: -1.0dB             MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

```
CHANNEL2 CARRIER-TO-NOISE
CARRIER: 880.0MHz        OUTLVL: -50.00dBm
C/N: -1.0dB             MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

**C/N**

**Definition**
Sets the carrier-to-noise ratio for the selected RF channel.

**Value Range**
Depends on the specific RF options installed. See technical specifications for details.

## 2.5.6. Setting the Receiver Bandwidth (RECEIVER BW)

If the units selected in the carrier-to-noise mode are **C/N**, the ratio programmed will represent the relative difference between the carrier signal power (dBm) and the total noise power (dBm) present in the user-specified receiver bandwidth. This receiver bandwidth must be established so the proper amount of noise spectral density can be defined over the specified band. The following equation shows the relationship between $N_o$, the noise spectral density (dBm/Hz), and N, the noise power in a band:

$$N \text{ (dBm)} = N_o + 10 \log_{10} (\textbf{RECEIVER BW})$$

For example, the IS-98 CDMA test standard defines the carrier to noise ratio (C/N) as $I_{or}/I_{oc}$. Or equivalently, the ratio of the total carrier power ($I_{or}$) to the noise power ($I_{oc}$) in a 1.23 MHz band. For this test the RECEIVER BW should be set to 1.23 MHz.

> **NOTE:** Changing the Receiver Bandwidth parameter while the unit is in operating mode will cause the unit to go to standby mode and requires an AUTOSET be performed at the new selected Receiver Bandwidth.

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 880.0MHz        OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 880.0MHz        OUTLVL: -50.00dBm
C/N: -1.0dB            MEASURED:  -1.1dB
IMPAIRMENTS: on    RECEIVER BW:  1.23 MHz
```

### RECEIVER BW

**Definition**
Sets the receiver bandwidth for the selected RF channel.

**Value Range**
10 kHz to full Noise Filter bandwidth, in 10 kHz steps

## 2.5.7. Setting the Carrier-to-Noise Density (C/No) Ratio

When the instrument is configured for **C/No** units, the ratio programmed will represent the relative difference between the carrier signal power (dBm) and the noise density (dBm/Hz) present around the carrier signal frequency.  See Section 2.4.2, for selecting the carrier-to-noise units.

The carrier-to-noise density ratio can be set over a large range with 0.1 dB resolution.  The range of ratios that can be supported is dependent on the carrier input level and the desired output level.

The menus below display the programmed carrier-to-noise density ratio (**C/No**) and the currently measured ratio. The programmed ratio does not become valid until after an AUTOSET procedure is performed.  After a valid AUTOSET, the Channel 1 or Channel 2 AUTOSET LED will be illuminated.

After an AUTOSET operation, the impairment level will be set according to the desired ratio and the current carrier input level.  This impairment level will remain constant until the ratio is changed or a parameter is modified which invalidates the AUTOSET.  While in operating mode, the current measured ratio is displayed in the field to the right of the programmed value.  Differences between the programmed ratio and the measured ratio are due to variations in the carrier input level.  Prior to an AUTOSET, the MEASURED field will be blank.  The rate at which the MEASURED value changes is a function of the internal power meter averaging.  See section 2.5.15 for details on programming the averaging parameter for the internal power meter.

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz        OUTLVL: -50.00dBm
C/No: 59.9dBHz        MEASURED:  60.0dBHz
IMPAIRMENTS: on
```

```
CHANNEL2 CARRIER-TO-NOISE
CARRIER: 860.0MHz        OUTLVL: -50.00dBm
C/No: 59.9dBHz        MEASURED:  60.0dBHz
IMPAIRMENTS: on
```

**C/No**

**Definition**
Sets the carrier-to-noise density ratio for the selected RF channel.

**Value Range**
Depends on the specific RF options installed. See technical specifications for details.

### 2.5.8. Setting the Energy per Bit-to-Noise Density ($E_b/N_o$) Ratio

When the instrument is configured for $\mathbf{E_b/N_o}$ units, the ratio programmed will represent the relative difference between the carrier signal's energy per bit (dBm/bps) and the noise density (dBm/Hz) present around the carrier signal frequency.  See Section 2.4.1, for selecting the carrier-to-noise units.  See also Section 2.5.9, for programming the Carrier Bit Rate.

The energy per bit-to-noise density ratio can be set over a large range with 0.1 dB resolution.  The range of ratios that can be supported is dependent on the carrier input level, the desired output level, and the programmed Carrier Bit Rate.

The menus below display the programmed carrier-to-noise density ratio ($\mathbf{E_b/N_o}$) and the currently measured ratio. The programmed ratio does not become valid until after an AUTOSET procedure is performed.  After a valid AUTOSET, the Channel 1 or Channel 2 AUTOSET LED will be illuminated.

After an AUTOSET operation, the impairment level will be set according to the desired ratio and the current carrier input level.  This impairment level will remain constant until the ratio is changed or a parameter is modified which invalidates the AUTOSET.  While in operating mode, the current measured ratio is displayed in the field to the right of the programmed value.  Differences between the programmed ratio and the measured ratio are due to variations in the carrier input level.  Prior to an AUTOSET, the MEASURED field will be blank.  The rate at which the MEASURED value changes is a function of the internal power meter averaging.  See section 2.5.15 for details on programming the averaging parameter for the internal power meter.

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz      OUTLVL: -50.00dBm
Eb/No: 20.1dB          MEASURED: 20.0dB
IMPAIRMENTS: on    BIT RATE:     9600 bps
```

```
CHANNEL2 CARRIER-TO-NOISE
CARRIER: 860.0MHz      OUTLVL: -50.00dBm
Eb/No: 20.1dB          MEASURED: 20.0dB
IMPAIRMENTS: on    BIT RATE:     9600 bps
```

**$E_b/N_o$**

**Definition**
Sets the energy per bit-to-noise density ratio for the selected RF channel.

**Value Range**
Depends on the specific RF options installed. See technical specifications for details.

## 2.5.9. Setting the Carrier Bit Rate

When the instrument is configured for **$E_b/N_o$** units, the ratio programmed will represent the relative difference between the carrier energy per bit (dBm/bps) and the noise spectral density (dBm/Hz) present around the carrier frequency.  To establish the energy per bit, a carrier bit rate must be specified.  The bit rate is used to normalize the carrier power according to the following equation:

$E_b$ = Carrier Power (C)/Information Bit Rate

The Bit Rate specified most often refers to the actual information rate, not the raw channel bit rate.  The raw channel bit rate usually includes channel coding, i.e. multiple channel bits per information bit.

To illustrate this point, the IS-97 CDMA test standard requires FER performance of the base station receiver to be evaluated versus different $E_b/N_o$ conditions. These conditions are specified for multiple information rates (e.g. 9600 bps, 4800 bps, 2400 bps).  CDMA systems operate with a high processing gain due to the fact that multiple channel bits are used to encode a single information bit. Although the raw channel rate is 1.228 Mb/s in this example, the carrier energy is normalized by the actual information rate, for instance 9600 bps.  In this case the user would program the 4600A for a BIT RATE of 9600.

> **NOTE:** Changing the Carrier Bit Rate parameter while the unit is in operating mode will cause the unit to go to standby mode and requires an AUTOSET be performed at the new selected Carrier Bit Rate.

```
CHANNEL1 CARRIER-TO-NOISE
CARRIER: 860.0MHz        OUTLVL: -50.00dBm
Eb/No: 20.1dB           MEASURED: 20.0dB
IMPAIRMENTS: on    BIT RATE:     9600 bps
```

```
CHANNEL2 CARRIER-TO-NOISE
CARRIER: 860.0MHz        OUTLVL: -50.00dBm
Eb/No: 20.1dB           MEASURED: 20.0dB
IMPAIRMENTS: on    BIT RATE:     9600 bps
```

**BIT RATE**

**Definition**
Sets the carrier bit rate for the selected RF channel.

**Value Range**
100 to 20,000,000

### 2.5.10. Setting the Carrier-to-Interference Ratio (C/I)

When using the instrument in the carrier-to-interference impairment mode the ratio programmed will represent the relative difference between the carrier signal power (dBm) and the interference source power (dBm).  See Section 2.5.1 for setting the Channel Impairment Mode.  See Section 2.4.3 for setting the Interference Source Status.

The C/I mode is useful for performing tests with non-noise interference sources such as CDMA Receiver Desensitization Tests.  These tests utilize a CW signal to act as a jamming signal.  See Section 8.1 "*Appendix 1: Standard Test and Factory Default Profiles*" for examples of this type of test.  This interference signal can be either supplied externally to the unit or the 4600A can be equipped with an optional internal dual tone synthesizer.

The carrier-to-interference ratio can be set over a large range with 0.1 dB resolution.  The range of ratios that can be supported is dependent on the carrier input level, the desired output level, and the interference level.

The menus below display the programmed carrier-to-interference ratio (**C/I**) and the currently measured ratio. The programmed ratio does not become valid until after an AUTOSET procedure is performed.  After a valid AUTOSET, the Channe1 l or Channel 2 AUTOSET LED will be illuminated.

After an AUTOSET operation, the impairment level will be set according to the desired ratio and the current carrier output level.  This impairment level will remain constant until the ratio is changed or a parameter is modified which invalidates the AUTOSET.  While in operating mode, the current measured ratio is displayed in the field to the right of the programmed value.  Differences between the programmed ratio and the measured ratio are due to variations in the carrier input level.  Prior to an AUTOSET, the MEASURED field will appear blank.  The rate at which the MEASURED value changes is a function of the internal power meter averaging.  See section 2.5.15 for details on programming the averaging parameter for the internal power meter.

```
CHANNEL1 CARRIER-TO-INTERF                    ⇩
CARRIER: 880.0MHz         OUTLVL: -40.00 dBm
C/I: -1.0dB               MEASURED:  -1.1 dB
IMPAIRMENTS: on
```

```
CHANNEL2 CARRIER-TO-INTERF                    ⇩
CARRIER: 880.0MHz         OUTLVL: -40.00 dBm
C/I: -1.0dB               MEASURED:  -1.1 dB
IMPAIRMENTS: on
```

## C/I

**Definition**
Sets the carrier-to-interference ratio for the selected RF channel.

**Value Range**
Depends on the specific RF options installed. See technical specifications for details.

### 2.5.11. Setting the Noise Generator Parameters

When using the 4600A in the noise generator mode the instrument will act as a programmable noise source and not take in a carrier signal.  See Section 2.5.1 for setting the Channel Impairment Mode.  See Section 2.4.1 for setting the Noise Generator Units.

### Setting Noise Output Power In a Specified Receiver Bandwidth

The output noise level can be set over a large range with 0.1 dB resolution. The range of levels that can be supported depend upon the programmed receiver bandwidth.  See Section 7.0 *"Technical Specifications"* for additional details on the ranges of levels supported.

The menu below displays the programmed noise output level when Noise Generator Mode is selected and the Noise Generator Units are set to **dBm**.  When configured in this way, the 4600A will output the noise level indicated in the **NSLVL** field over a bandwidth specified by the **RECEIVER BANDWIDTH** parameter.  See Section 2.5.6 for setting the Receiver Bandwidth.  Although the 4600A will accurately output the power level specified in the given receiver bandwidth, the internal noise source has a power spectrum larger than the receiver bandwidth.  Thus a wideband measuring device will measure a value larger than that displayed in the NSLVL field if attached to the 4600A RF Out front panel connector.

The programmed level does not become valid until after an AUTOSET procedure is performed.  After a valid AUTOSET, the Channel 1 or Channel 2 AUTOSET LED will be illuminated.

```
CHANNEL1 NOISE GENERATOR
CARRIER: 880.0 MHz    NSLVL: -40.0 dBm
RECEIVER BW:  1.23 MHz
IMPAIRMENTS: on
```

```
CHANNEL2 NOISE GENERATOR
CARRIER: 880.0 MHz    NSLVL: -40.0 dBm
RECEIVER BW:  1.23 MHz
IMPAIRMENTS: on
```

**Noise Generator Output Power Level (OUTLVL)**

**Definition**
Sets the noise power in a band when Noise Generator Units are set to dBm in
Noise Generator mode.

**Value Range**
Depends on the specific RF options installed. See technical specifications for details.

### Setting Noise Generator Receiver Bandwidth

The menu below displays the receiver bandwidth when Noise Generator Mode is selected and the Noise Generator Units are set to **dBm**.  When configured in this way, the 4600A will output the noise level specified over a bandwidth given by the **RECEIVER BANDWIDTH** parameter. This receiver bandwidth must be established so the proper amount of noise spectral density can be defined over the specified band.  The following equation shows the relationship between $N_o$, the noise spectral density (dBm/Hz), and noise power in a band:

$$N \text{ (dBm)} = N_o + 10 \log_{10} (\textbf{RECEIVER BW})$$

Although the 4600A will accurately output the power level specified in the given receiver bandwidth, the internal noise source has a power spectrum larger than the receiver bandwidth and thus a wideband measuring device will measure a value larger than displayed in the NSLVL field if attached to the 4600A RF Out front panel connector.

```
CHANNEL1 NOISE GENERATOR
CARRIER: 880.0 MHz    NSLVL: -40.0 dBm
RECEIVER BW:  1.23 MHz
IMPAIRMENTS: on
```

```
CHANNEL2 NOISE GENERATOR
CARRIER: 880.0 MHz    NSLVL: -40.0 dBm
RECEIVER BW:  1.23 MHz
IMPAIRMENTS: on
```

**RECEIVER BW**

**Definition**
Sets the receiver bandwidth for the selected RF channel.

**Value Range**
10 kHz to full Noise Filter bandwidth, in 10 kHz steps

## Setting Output Noise Power Density

The output noise level density can be set over a large range with 0.1 dB resolution. The range of levels that can be supported depend on the particular RF options with which the 4600A is equipped.  See Section 7.0, "*Technical Specifications*," for additional details on the ranges of levels supported.

The menu below displays the programmed output noise power density when Noise Generator Mode is selected and the Noise Generator Units are set to **dBm/Hz**.  When configured in this way, the 4600A will output the noise power density indicated in the **NSLVL** field at the specified carrier frequency.

The programmed level does not become valid until after an AUTOSET procedure is performed.  After a valid AUTOSET, the Channel 1 or Channel 2 AUTOSET LED will be illuminated.

```
CHANNEL1 NOISE GENERATOR
CARRIER: 880.0 MHz   NSLVL:-100.0 dBm/Hz
IMPAIRMENTS: on
```

```
CHANNEL2 NOISE GENERATOR
CARRIER: 880.0 MHz   NSLVL:-100.0 dBm/Hz
IMPAIRMENTS: on
```

**Noise Generator Output Power Density (NSLVL)**

**Definition**
Sets the noise power density when Noise Generator Units are set to dBm/Hz in Noise Generator mode.

**Value Range**
Depends on the specific RF options installed. See technical specifications for details.

### 2.5.12. Using Carrier Attenuator Mode

In Carrier Attenuator mode, the TAS 4600A allows the user to specify a precise output level for the carrier signal.  A standard 4600A can provide a wide dynamic range of programmable insertion loss in the carrier channel path with 0.25 dB resolution. When operating in this mode, no impairments are added to the carrier signal.

Even though a carrier-to-noise ratio does not have to be set, an AUTOSET is still required to allow the 4600A to measure the input carrier signal and scale it to the desired output level.

---

**NOTE:**  When the instrument is in standby mode when using Carrier Attenuator mode a signal path *will* exist through the 4600A at the instrument's minimum insertion loss (gain).

Changing the Carrier Frequency parameter while the unit is in operating mode will cause the unit to go to standby mode and requires an AUTOSET be performed at the new selected frequency.

---

```
CHANNEL1 CARRIER ATTENUATOR
CARRIER: 880.0MHz          OUTLVL: -40.00dBm
```

```
CHANNEL2 CARRIER ATTENUATOR
CARRIER: 880.0MHz          OUTLVL: -40.00dBm
```

### 2.5.13. Using Interference Generator Mode

When the 4600A is equipped with the dual internal synthesizer option, the unit may be configured as an Interference Generator. In **Interference Generator** mode, the TAS 4600A allows the user to specify the output level and frequency of up to two independent interference signals. Either one or both internal CW sources must be selected as the active Interference source. See Section 2.4.3 "*Selecting the Status of Interference Source A and Interference Source B*" for further details on selecting the internal CW sources as the active interference sources.

The frequency of the interference signal(s) must be within the band of the current CH1 or CH2 frequency. See Section 2.4.4 "*Setting the Frequency of CW Source A and CW Source B*" for further details on setting the frequencies of the internal CW sources. The output power resolution can be expanded when the instrument is equipped with an optional high-resolution output attenuator.

To select Interference Generator mode, make either the CH1 or CH2 menu the current screen as shown below:

Current screen...

```
CHANNEL1
MODE: interference generator⏎
```

Press Enter key...

```
CHANNEL1 INTERF GENERATOR                    ⇩
BAND: 800-1000MHz        OUTLVL: -50.00dBm
IMPAIRMENTS: on
```

An AUTOSET is required to allow the 4600A to establish the desired output level.

> **NOTE:** Changing the frequency band while the unit is operating mode will cause the unit to go to standby mode and requires an AUTOSET be performed at the new selected frequency band.
>
> Changing the internal CW source frequency parameter while the unit is in operating mode will cause the unit to go to standby mode and requires an AUTOSET be performed at the new selected frequency.

## 2.5.14. Performing an AUTOSET Operation

Regardless of the Channel Impairment Mode specified, the user must perform an AUTOSET operation on the TAS 4600A before beginning performance testing. An AUTOSET key for each channel is located in the AUTOSET section at the bottom of the front panel.  The purpose of the AUTOSET procedure is to allow the 4600A to set the appropriate level of noise or interference relative to the measured carrier power and the current parameter settings.

At power-up, or after parameters have been modified that require another AUTOSET to be performed, the AUTOSET LEDs will not be illuminated, indicating that the unit is in standby mode.

NOTE:  When the instrument status is in standby a signal path *will* exist through the 4600A.

Pressing the **AUTOSET** key will initiate the AUTOSET process.  During the AUTOSET process the 4600A will measure the carrier input signal and/or all necessary impairment signals and attempt to set the levels programmed by the user.

NOTE:  In earlier instruments not equipped with the Bypass feature, the carrier signal path will be temporarily broken during the AUTOSET process while the 4600A measures the additive impairments.  This signal interruption applies to Carrier-to-Noise and Carrier-to-Interference modes.

If the AUTOSET is successful, the AUTOSET LED for the appropriate channel will be illuminated and that channel will be in operating mode.

Once in operating mode, a select group of parameters may be modified without requiring another AUTOSET.  These include:

C/N                     C/No    OUTLVL

$E_b/N_o$                    C/I

The parameters listed above can be stepped over all or part of their total range without requiring another AUTOSET to be performed.  If a parameter is stepped out of the range made possible by the current AUTOSET, the 4600A will turn off the AUTOSET LED for the affected channel and the initiation of a new AUTOSET procedure will be required.  Changing any parameter not listed above will also require the execution of a new AUTOSET process.

If the AUTOSET process is not successful, the instrument will display a context specific message indicating the reason the operation could not be completed. These include the following:

```
Input level too high
Press ESC to continue


```

The message above indicates the carrier signal is above the maximum allowable input level. Reduce the carrier power before trying another AUTOSET procedure.

```
Input level too low
Press ESC to continue


```

The message above indicates the carrier signal is below the minimum allowable input level. Increase the carrier power before trying another AUTOSET procedure.

```
Output Level out of range
Press ESC to continue


```

The message above indicates the output level specified is incompatible with the user supplied carrier input level. This can be caused by two possible conditions.

- The output level specified is larger than the input signal less the minimum insertion loss of the instrument. See Section 7.0 "*Technical Specifications*" for the specified minimum carrier insertion loss.

- The output level specified is smaller than the input signal less the maximum programmable insertion loss of the instrument. See Section 7.0 "*Technical Specifications*" for the specified maximum carrier insertion loss.

```
C/N out of range
Press ESC to continue
```

The message above indicates the specified C/N value was incompatible with the user supplied carrier signal power and the desired carrier output power level.  The charts in Figures 2-2 to 2-7 show compatible C/N Ratios vs. Output Power Levels for three given input levels.  The shaded region of the graphs represents permissible parameter combinations.

> **NOTE:** The following graphs represent one Input Level scenario and are not indicative of the limits presented by other parameter combinations.  TASKIT 4600A Windows Software, included with the instrument, can be used to determine the valid ranges for other parameter combinations.

**Parameter Assumptions**

For C/N axis:
Receiver Bandwidth = 1.23 MHz

For $E_b/N_o$ axis:
Bit Rate = 9600 bps
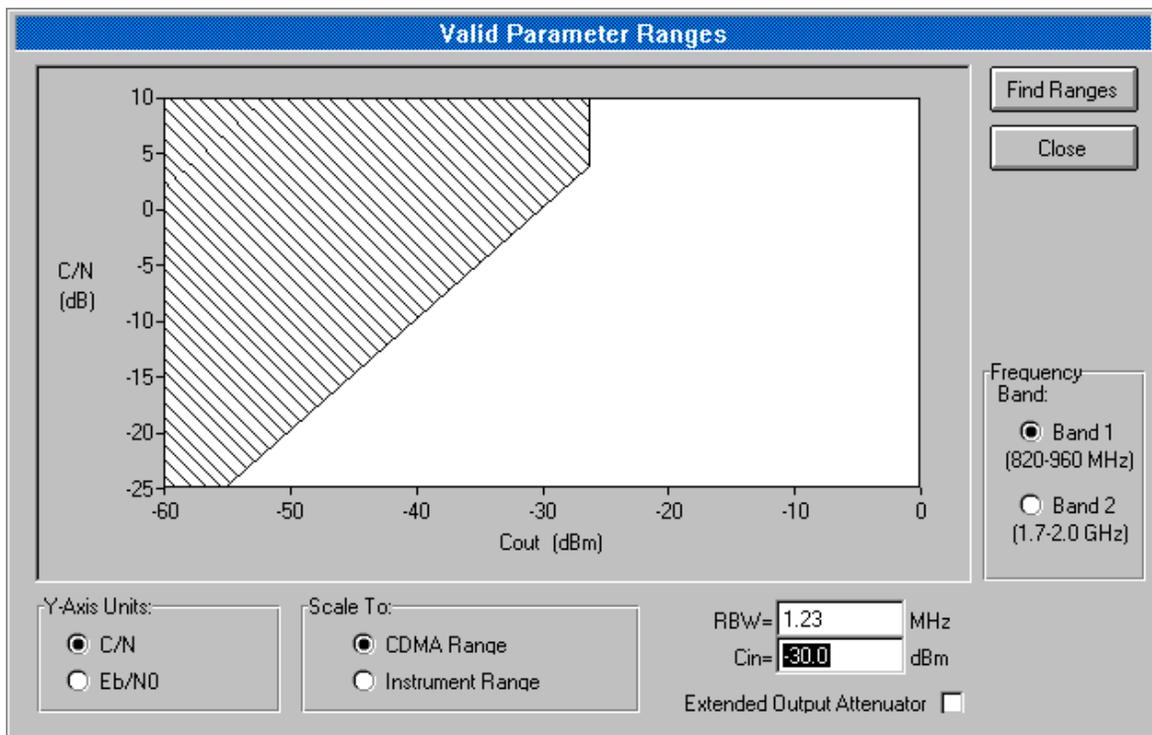


**Figure 2-2. Output Power Level vs. C/N at an Input Level of -30 dBm**
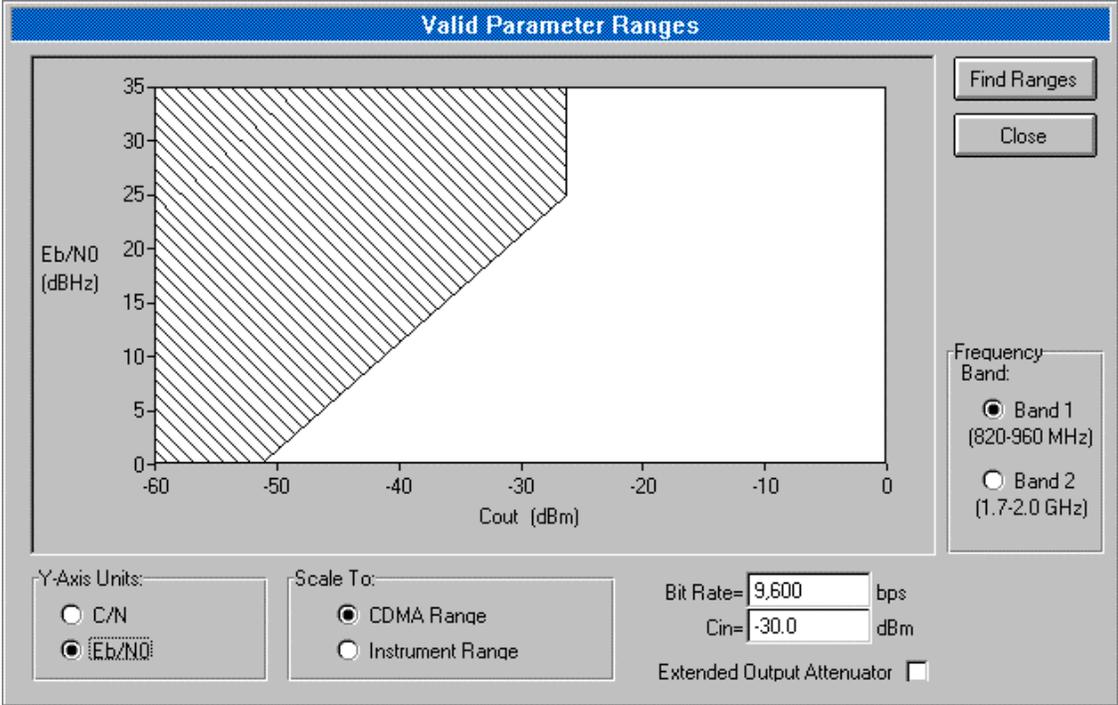
**Figure 2-3. Output Power Level vs. Eb/No at an Input Level of -30 dBm**
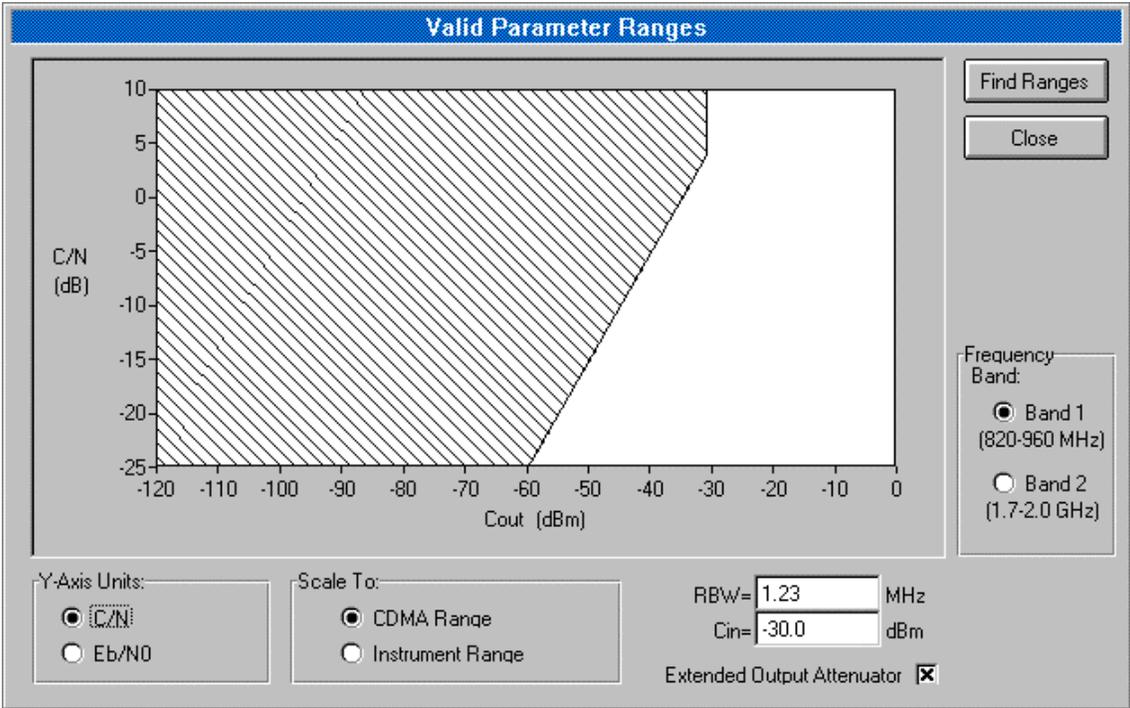


**Figure 2-4. Output Power Level vs. C/N at an Input
Level of -30 dBm with Extended Output Range option**
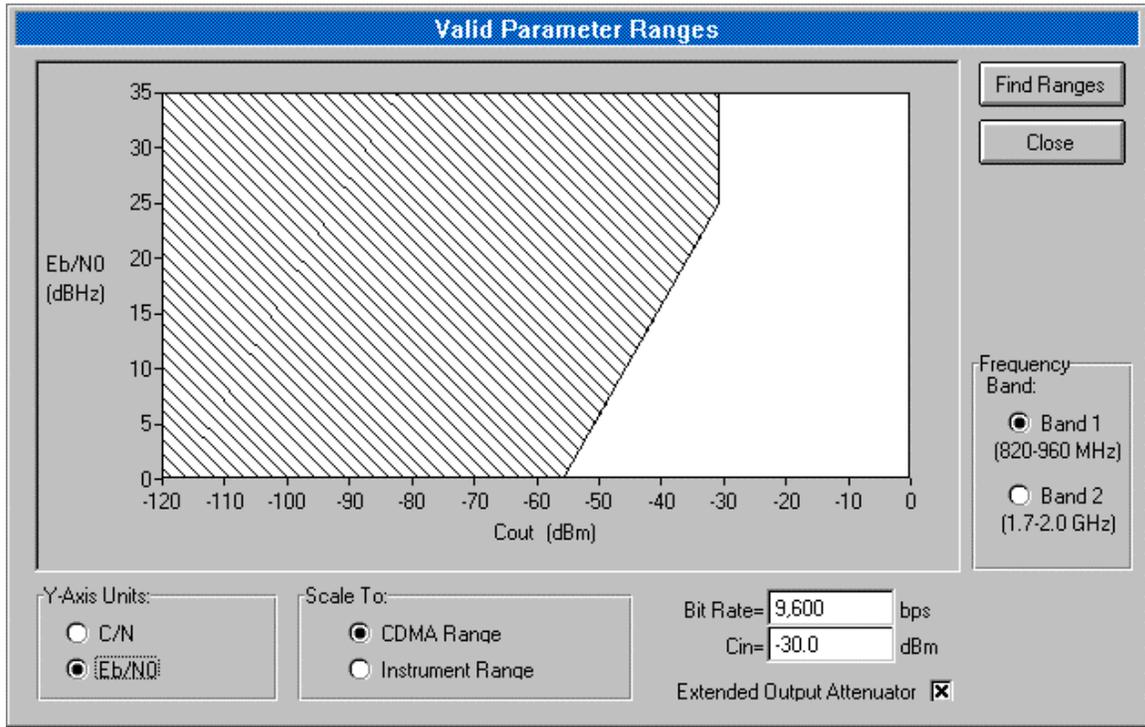
**Figure 2-5. Output Power Level vs. Eb/No at an
Input Level of -30 dBm with Extended Output Range option**

## 2.5.15. Setting Channel Bypass

The bypass feature of the TAS 4600A allows the user to create a minimum-loss path between the RF IN and RF OUT connectors on the front panel.  In this mode, the input signal is routed through the carrier path with minimum attenuation and no noise or impairments are added.

Within the BYPASS group on the front panel are two keys and two LEDs.  To activate the bypass for Channel 1 or Channel 2, press the Channel 1 or Channel 2 key within the BYPASS group.  When a particular channel is bypassed, the Bypass LED for that channel will be illuminated.  Pressing the bypass key a second time will cancel the bypass and the LED will be turned off.

> **NOTE:**  Activating bypass for a particular channel automatically puts the 4600A into standby mode.  Removing the bypass does not restore the operating condition.  A new AUTOSET must be performed to restore operating mode.

While a channel is being bypassed, all parameters for that channel can be viewed and set as necessary.  These changes will not take effect until an AUTOSET is performed, which can not be done until the bypass is removed.

The bypass status for each channel is saved in the user files.  See section 2.2.2 "*Defining and Saving Custom Test Configurations*".

### 2.5.16. Setting the Number of Measurement Averages

An internal instrument-grade power meter enables the 4600A to make very accurate measurements for setting carrier and impairment signal levels. The internal power meter can be programmed to provide a range of software averaging to accommodate different measurement objectives. To increase measurement accuracy and smooth out variations in the measured signal a longer averaging time can be programmed. For example, longer averaging times are useful for measuring input carrier signals that are undergoing multipath fading. To track real-time changes in the measured signal little or no averaging can be used. Shorter averaging times prove useful for monitoring the effects of carrier signal power control.

The amount of averaging will apply to all measurements taken by the power meter. These include the input carrier power measurement, the AUTOSET procedure, and the real-time C/N measurement function.

Each average is taken over a 400 ms time window. For applications with a constant carrier signal power, an averaging factor of 2 is recommended. The menu below enables the AVERGAGES parameter to be modified.

```
MEASURE                                           ⇩
MONITOR:ch1 input        MEASURED: -17.6 dBm
AVERAGES: 2              DUTY CYCLE: 100%
```

**AVERAGES**

**Definition**
Sets the number of averages performed by the internal power meter.

**Value Range**
1, 2, 4, 8, 16, 32, 64, 128, Auto

The following table provides a suggested number of averages when the input signal is a single-path Rayleigh faded signal.

| Speed | Doppler @ 878.5 MHz | # Averages |
|---|---|---|
| 100 km/hr | 81.4 | 16 |
| 50 km/hr | 40.7 | 32 |
| 30 km/hr | 24.4 | 64 |
| 8 km/hr | 6.5 | 128 |
| 4 km/hr | 3.3 | 128 |

**NOTE:** Auto averaging is **not** recommended for Rayleigh faded signals.

### 2.5.17. Setting the Measurement Duty Cycle

An internal instrument-grade power meter enables the 4600A to make very accurate measurements for setting carrier and impairment signal levels.  This wideband measuring device can be programmed to measure bursty or pulsed input signals by specifying the duty cycle of the bursty signal.  The duty cycle is represented as the percentage of time the burst is active. A TDMA carrier signal is an example of a carrier signal that transmits in bursts.

Burst power is based on a mathematical calculation which modifies the actual power meter measurement.  The power meter measures the average power of the bursty input signal and then divides the measurement by the duty cycle to arrive at the final reading.  Variations between the programmed duty cycle and the carrier signals actual duty cycle will affect measurement accuracy.

The duty cycle factor will apply to all measurements taken by the power meter of the carrier signal.  These include the input carrier power measurement, the AUTOSET procedure, and the real-time C/N measurement function.  The menu below enables the DUTY CYCLE parameter to be modified.

```
MEASURE                                          ⇩
MONITOR:ch1 input        MEASURED: -17.6 dBm
AVERAGES: 2              DUTY CYCLE: 100%
```

**DUTY CYCLE**

**Definition**
Sets the duty cycle percentage used by the internal power meter.

**Value Range**
1% to 100% in 1% steps

### 2.5.18. Monitoring the Input Carrier Signal

The 4600A contains a wideband power meter that can be used to measure the carrier input signal present at either the Channel 1 or Channel 2 input connectors. Input carrier monitoring is activated anytime the user moves to the menu shown below.  The measured value is displayed in the MEASURED field.

```
MEASURE                                         ⇩
MONITOR:ch1 input        MEASURED: -17.6 dBm
AVERAGES: 2              DUTY CYCLE: 100%
```

The user can switch the currently active monitor point by modifying the MONITOR field.  It is recommended that the carrier frequency of the input carrier signal be correctly entered, as this will affect the measurement accuracy.  See Section 2.5.3 for details on setting the input carrier signal frequency.

The update rate of the MEASURED value will also be affected by the number of power meter averages that are currently set.  See Section 2.5.15 for instructions on setting the number of measurement averages.

For bursty or pulsed signals, the 4600A power meter DUTY CYCLE parameter must be set appropriately to obtain accurate measurements.  See Section 2.5.16 for details on setting the carrier signal duty cycle value.

**MONITOR**

**Definition**
Sets the input carrier signal monitor point.

**Value Range**
ch1 input, ch2 input

### 2.5.19. Zeroing the Internal Power Meter

Performing a zeroing operation on the internal power meter periodically enables the instrument to calibrate the power meter's internal circuitry for a zero power indication when no power is applied to the meter.  Zeroing helps insure accurate power measurements at low signal levels.

It is not necessary to disconnect any test setup cables from the 4600A before the zeroing operation.  The instrument will internally terminate the input to the power meter to guarantee no signal is present at the input to the meter during the procedure.

```
MEASURE                                          ⇕
Press enter to zero power meter.↵


```

**ZERO POWER METER**

**Definition**
Zeros the internal power meter.

**Value Range**
None

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# 3.0. REFERENCE

## 3.1. Overview

This section of the operations manual provides reference information that describes the features provided by the TAS 4600A Noise & Interference Emulator. This includes all connectors, indicators, and input/output ports on the front and rear panels of the TAS 4600A.

## 3.2. Interfaces

The front panel contains the display, Autoset and menu group keys, and RF input/output N-type connectors. The rear panel contains the external interferer inputs, remote control interfaces (IEEE-488 and RS-232), auxiliary (AUX) port, PCMCIA System Firmware Interface, power entry module, and fan vent area.

### 3.2.1. Front Panel Displays and Interfaces

On the front right hand side of the TAS 4600A, shown in Figure 3-1, is the display, menu group LEDs, and remote LED. On the left hand side of the front panel are the channel RF I/O N-type connectors.
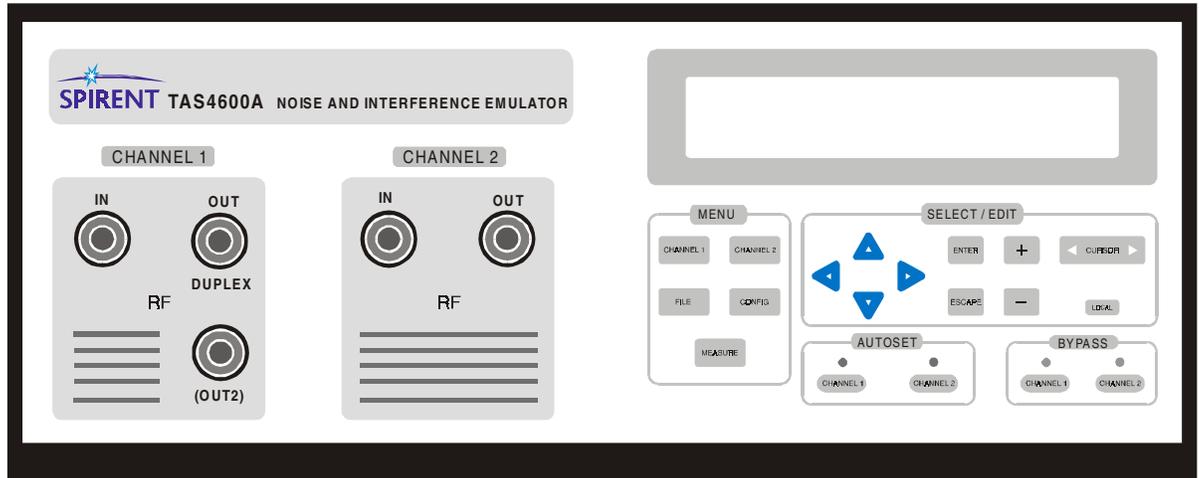


**Figure 3-1. TAS 4600A Front Panel**

## Display

The TAS 4600A has an eighty character display on the front panel.  The display will show the active menu tree.  All parameters for the system, input/output, and path characteristics are visible from the front panel display.  Error messages are also displayed here.

## Autoset LEDs

The autoset LEDs are located directly beneath the AUTOSET keys on the front panel.  When the TAS 4600A is first powered on, these LEDs will not be lit, indicating that an impaired channel has not yet been achieved.  When the user presses the autoset key, this LED will turn green if the function was successful.  After performing a successful autoset, these LEDs will remain lit until the user changes a parameter which invalidates the current state of the instrument (e.g. changing the carrier frequency parameter).  Note that turning off channel impairments will not affect the state of the LED, although the RF output signal will be modified.

## Bypass LEDs

The bypass LEDs are located directly beneath the BYPASS keys on the front panel.  When the user presses the BYPASS key, the channel is configured in a minimum-loss condition, with all impairments disabled.  If the instrument had previously been in an operational mode (indicated by a green autoset indicator), it will be forced into a non-operational mode.

## RF Input/Output N-Connectors

There are three N-type connectors on channel 1 and two N-type connectors on channel 2.  The transmit signal must be applied to the connector labeled "RF IN."  An impaired signal will be present at the connector labeled "RF OUT."  If the optional internal duplexer is installed, the connector labeled "RF OUT" acts as a bi-directional port, and the signal received from the device under test is available at the connector labeled "RF OUT 2".  Figure 3-2 illustrates a functional diagram of the internal RF circuit.  Refer to Section 7 for detailed technical information on the duplexer option.
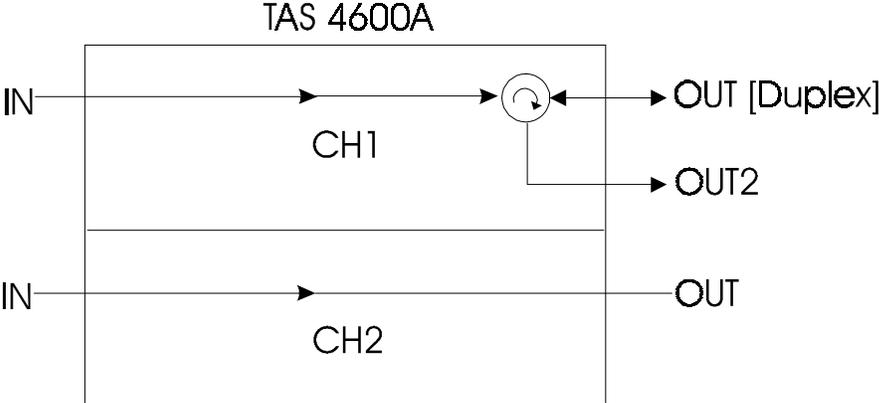
**Figure 3-2. Functional Diagram of TAS 4600A Connectors**

### 3.2.2. Rear Panel Interfaces

On the TAS 4600A rear panel, shown in Figure 3-3, is the RS-232 and IEEE-488 remote interfaces, auxiliary port, 10 MHz reference connector, and PCMCIA Software Card Interface.  The left side of the rear panel has the power entry module and fan vent areas.
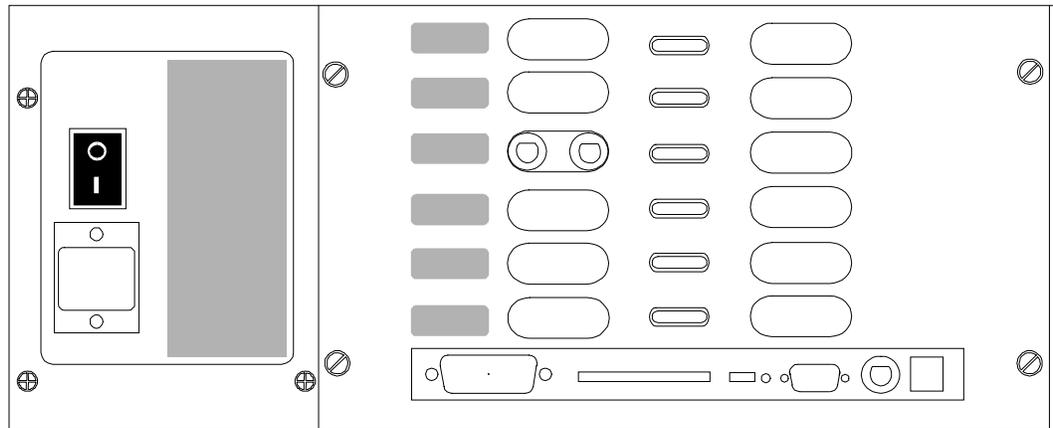


**Figure 3-3. TAS 4600A Rear Panel**

## Dual External Interferer Interface

A pair of external interference inputs are located on the rear of the TAS 4600A. These two SMA type connectors are labeled EXT A and EXT B.  Interference signals can be input into the instrument and added to the carrier signal in either 4600A channel.  The nominal input level into these inputs is 0 dBm.  See Section 2.4.3 "*Selecting the Status of Interference Source A and Interference Source B*" for further details on using these signal inputs.  See Section 7.0 "*Technical Specifications*" for information regarding the frequency range of these inputs and their maximum input power rating.

## PCMCIA Software Card Interface

The system software for the TAS 4600A is resident on a PCMCIA memory card. This card plugs into the PCMCIA System Software Interface on the lower portion of the instrument's rear panel.  This PCMCIA card makes it easy to upgrade to the latest firmware version.

### IEEE-488 Remote Control Port

The CONTROL (IEEE-488) port is a 24 pin IEEE-488 receptacle which supports the IEEE-488 (GPIB) protocol. This port must be connected to an IEEE-488 controller to control the TAS 4600A via IEEE-488. This connection may be either direct or via multi-point bus which contains other IEEE-488 controlled equipment.

The IEEE-488 controller can be a generic PC with an embedded IEEE-488 control card installed, an IEEE-488 computer, an RS-232 to IEEE-488 converter, or some other IEEE-488 controller.

### RS-232C Remote Control Port

The CONTROL (DTE) port is a 9 pin female D-sub connector which supports RS-232C. The control port is wired as a Data Communications Equipment (DCE). All RS-232C remote control of the TAS 4600A must be done via this port. An RS-232C terminal or a PC (IBM compatible) can control the TAS 4600A through this port via a regular RS-232 cable. It is important to note that a null modem cable is not required. Two protocols are supported in RS-232 control mode, ACK/NAK (ACKnowledge/Negative AcKnowledge), and CR/LF (Carriage Return/Line Feed). Both of these protocols are explained in full detail in section 4.0. "*Remote Operation*" of this manual.

### AUX Port

The AUX (auxiliary) port is a RJ-45 connector that is currently not used.

### 10 MHz Reference Connectors

The 10 MHz reference connectors are not currently used.

### AC Power Receptacle

The AC power receptacle is located in the lower left corner of the rear panel. The TAS 4600A has an autosensing AC voltage that is designed to operate from a line voltage of 85 to 265 volts at 47 to 63 Hz. This receptacle also contains the fuse for the unit. If it becomes necessary to change the fuse, the proper procedure for performing the operation is described below:

1. Remove the power cord and slide the fuse holder out of the power entry module.

2. Replace the fuse with the appropriate type (see technical specifications).

3. Reinsert the fuse holder into the power entry module.

**Fan Vent Areas**

The TAS 4600A contains two fan vent areas.  One vent area is to the right of the AC power receptacle, the other is on the left side panel. The space near these vents should be unobstructed for proper air flow to cool the TAS 4600A.

### 3.3. Application Specific Configurations

#### 3.3.1. CDMA Mobile Receiver Testing with a TAS 4600A and TAS 4500

CDMA test specifications require the performance of mobile stations to be evaluated over a variety of propagation and interference environments.  To perform these tests, instruments which emulate the essential propagation, carrier-to-noise, and carrier-to-interference conditions, are required.

Using a TAS 4500 RF Channel Emulator and TAS 4600A Noise and Interference Emulator together combines all elements required for these tests into one integrated system (CDMA-LAB) and, when coupled with a Base Station Emulator, provides a complete end-to-end test solution.

The TAS 4500 FLEX4 RF Channel Emulator implements a superset of all the RF channel conditions, such as multi-path fading, delay spread, and path loss, required for CDMA receiver testing. The TAS 4600A Noise & Interference Emulator emulates the co-channel and adjacent channel interference conditions required for testing CDMA receiver performance in the presence of Additive White Gaussian Noise (AWGN) and adjacent channel Continuous Waveform (CW) interferers.

The procedure that follows shows a detailed test setup utilizing CDMA-LAB  in conjunction with a Base Station Emulator for evaluating the receiver performance of a mobile station.

### 3.3.2. Demodulation of Forward Traffic Channel in Multipath Fading Tests

The test suite outlined below configures CDMA-LAB and the Base Station Emulator to evaluate the demodulation performance of a CDMA mobile phone in the presence of multi-path fading and AWGN.  The functional test setup (See Figure 3-4.) is taken from *Section 9.3.4 Demodulation of Forward Traffic Channel in Multipath Fading Channel* found in IS-98A "*Recommended Minimum Performance Standards for Dual-Mode Wideband Spread Spectrum Cellular Mobile Stations*".
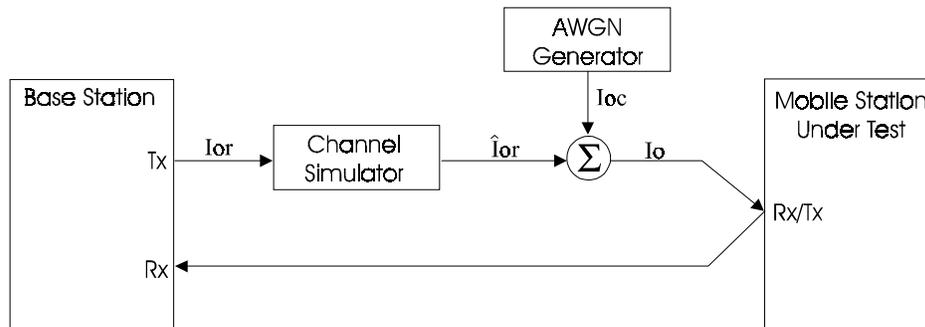


**Figure 3-4.. IS-98A Mobile Station Test Configuration**

The equivalent configuration using the TAS CDMA-LAB is shown in Figure 3-5.
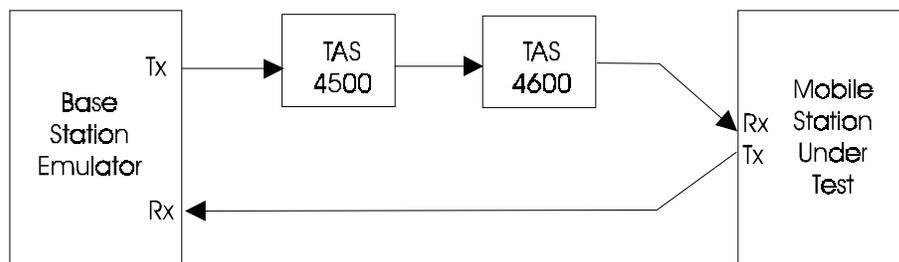


**Figure 3-5.. TAS CDMA-LAB Test Configuration**

### 3.3.3. Test Conditions

The test conditions for the $E_b/N_o$ settings are taken from *Table 9.3.4.2-3 Test Parameters for Forward Traffic Channel Rate Set 1 in Fading Channel (Case 3)* of IS-98A and are shown below in Table 3-1.

| Parameter | Units | Test 10 |
|---|---|---|
| $I_{or}/I_{oc}$ | dB | 2 |
| Pilot $E_c/I_{or}$ | dB | -7 |
| Traffic $E_c/I_{or}$ (for 9600 bps) | dB | -14.7 |
| $I_{oc}$ | dBm/1.23 MHz | -57 |
| Data Rate | bps | variable |
| Traffic $E_b/N_t$ | dB | 5.3 |

**Table 3-1. Test Conditions**

The test conditions for the channel simulator is shown below in Table 3-2.

| CHANNEL SIMULATOR CONFIGURATION | 4 |
|---|---|
| Vehicle Speed [km/hr] | 100 |
| Number of Paths | 3 |
| Path 2 Power (Relative to Path1) [dB] | 0 |
| Path 3 Power (Relative to Path1) [dB] | -3 |
| Delay from Path 1 to Input [us] | 0 |
| Delay from Path 2 to Input [us] | 2 |
| Delay from Path 3 to Input [us] | 14.5 |

**Table 3-2. Channel Simulator Configuration**

### 3.3.4. Equipment Setup

The test setup required to implement this procedure is provided below in Figures 3-6 and 3-7.  The Base Station Emulator performs the functions of an actual base station, and TAS CDMA-LAB emulates the necessary radio channel environment. A CDMA mobile station (MS) acts as the unit under test (UUT).  If it is desirable to monitor the MS receive channel (Rx), an optional spectrum analyzer can be used along with a directional coupler.

#### Equipment Setup with Internal Duplexer Option
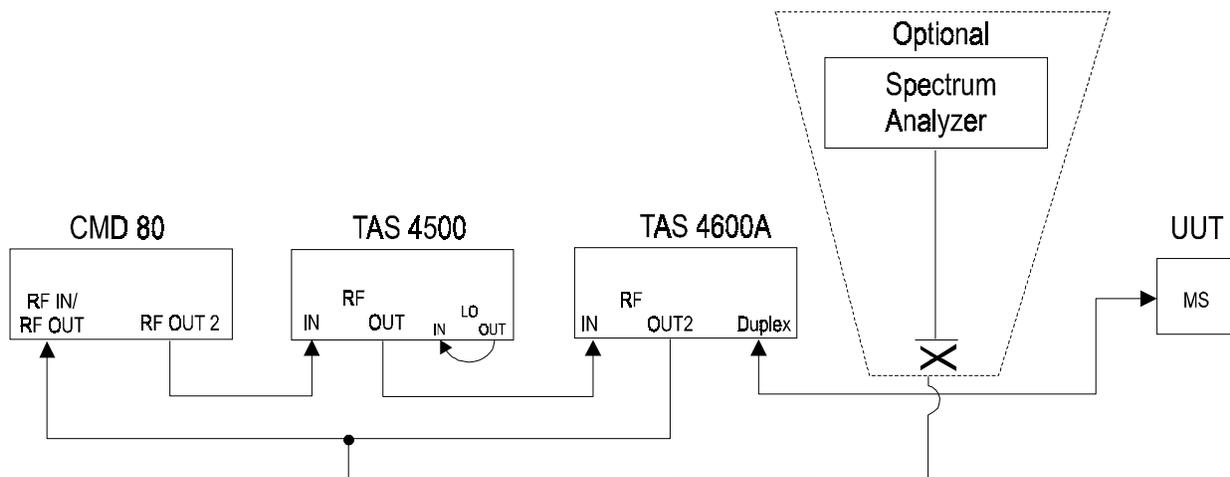


**Figure 3-6. Equipment Setup with Internal Duplexer Option**

Configure the test setup as depicted in Figure 3-6.

- Connect the TAS 4500 CH1 LO OUT (N-type) connector to the TAS 4500 CH1 LO IN (N-type) connector.

- Connect the Base Station Emulator RF Out  connector to the TAS 4500 CHANNEL 1 RF IN (N-type) connector.

- Connect the TAS 4500 CHANNEL 1 RF OUT (N-Type) connector to the TAS 4600A CHANNEL 1 RF IN (N-type) connector.

- Connect the TAS 4600A CHANNEL 1 RF OUT [DUPLEX] connector to the antenna port of the CDMA mobile phone.  This completes the connections required for the Forward Channel (Mobile Station Rx).

- Connect RF OUT2 on channel 1 of the TAS 4600A to the RF IN port of the Base Station Emulator.  This connection establishes the un-impaired Reverse Channel (Mobile Station Tx).

- After completing the interconnections outlined above, power-on all the instruments in the test setup.

NOTE: It is highly recommended to employ an RF shielded enclosure to house the CDMA mobile phone. This ensures the phone is not subjected to the ingress of background interference and receives only the impaired carrier signal provided by the test setup.

## Equipment Setup without Internal Duplexer Option
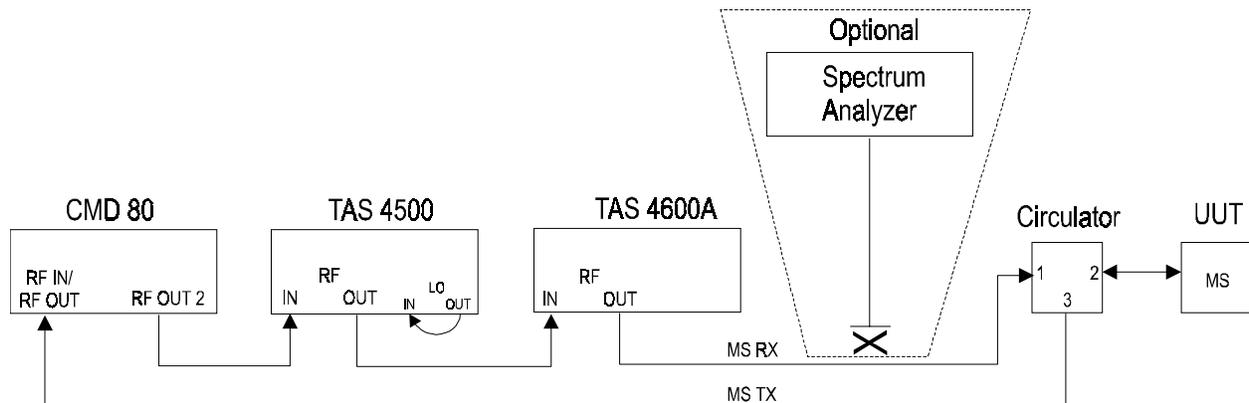


Figure 3-7. Equipment Setup without Internal Duplexer Option

Configure the test setup as depicted in Figure 3-7.

- Connect the TAS 4500 CH1 LO OUT (N-type) connector to the TAS 4500 CH1 LO IN (N-type) connector.

- Connect the Base Station Emulator RF Out connector to the TAS 4500 CHANNEL 1 RF IN (N-type) connector.

- Connect the TAS 4500 CHANNEL 1 RF OUT (N-Type) connector to the TAS 4600A CHANNEL 1 RF IN (N-type) connector.

- Connect the TAS 4600A CHANNEL 1 RF OUT (N-type) connector to Port1 of the Circulator.

- Connect Port 2 of the Circulator to the antenna port of the CDMA mobile phone. The Circulator is required since the CDMA Mobile Phone has a duplex antenna. This completes the connections required for the Forward Channel (Mobile Station Rx).

NOTE: It is highly recommended to employ an RF shielded enclosure to house the CDMA mobile phone. This ensures the phone is not subjected to the ingress of background interference and receives only the impaired carrier signal provided by the test setup.

- Connect Port 3 of the Circulator to the RF IN port of the Base Station Emulator. This connection establishes the un-impaired Reverse Channel (Mobile Station Tx).

- After completing the interconnections outlined above, power-on all the instruments in the test setup.

## 3.3.5. TAS CDMA-LAB Parameter Configuration

1. Recall the "**CDMA_4**" file on the TAS 4500 to initialize the instrument to a known state. This recall file will configure the instrument to the setup shown in Table 3-3.

2. Some of the parameters in the TAS 4500 need to be updated based on the carrier frequency set in the Base Station Emulator. Configure the TAS 4500 Channel 1 parameters (Channel 2 is not required for this specific setup) as shown in Table 3-3. Only the items in bold need to be updated. These settings directly reflect the 3-path model prescribed by the IS-98A standard and described in Table 3-2.

| TAS 4500 Configuration | | | | | | |
|---|---|---|---|---|---|---|
| **Configuration** | Velocity Units = km/h<br>Emulation Method - Jakes<br>Nominal Fading Repetition - 20 minutes<br>Correlation Algorithm - Envelope | | | | | |
| **Channel** | **1** | | | | | |
| Input Reference Level | **-10.0 dBm** | | | | | |
| Output Attenuator | 0 dBm | | | | | |
| LO Mode | **internal auto** | | | | | |
| Carrier Freq. (MHz) | **878.5** | | | | | |
| **Path** | **1** | **2** | **3** | **4** | **5** | **6** |
| Status | on | on | on | off | off | off |
| Relative Delay (μs) | 0.0 | 2.0 | 14.5 | - | - | - |
| Modulation Type | Rayl. | Rayl. | Rayl. | - | - | - |
| Doppler Freq. (Hz) | **81.4** | **81.4** | **81.4** | - | - | - |
| Velocity (km/h) | **100** | **100** | **100** | - | - | - |
| Fading Power Spectrum | C6* | C6* | C6* | - | - | - |
| Relative Loss (dB) | 0 | 0 | 3 | - | - | - |
| Log-normal Freq. (Hz) | 0 | 0 | 0 | - | - | - |
| Log-normal STD (dB) | 0 | 0 | 0 | - | - | - |

  * Fading Power Spectrum = Classical (6dB)

**Table 3-3. TAS 4500 Parameter Configuration**

3. To initialize the TAS 4600A to a known state, recall the "default" file on the instrument.

4. Configure the TAS 4600A Channel 1 parameters (Channel 2 is not required for this specific setup) as shown in Table 3-4. These settings reflect the requirements outlined by the IS-98A standard shown in Table 3-1.

The parameter $I_{or}/I_{oc} = 2.0$ found in Table 3-1 represents the ratio of the total carrier power to the noise power contained in a 1.23 MHz band.  This ratio of +2.0 is implemented in the 4600A by using the C/N Emulation Mode with a C/N Ratio of 2.0 and a Receiver Bandwidth of 1.23 MHz.  Since Table 1 also specifies $I_{oc}$ to be at an absolute power of -57 dBm/1.23 MHz and given an $I_{or}/I_{oc}$ ratio of 2.0, $I_{or}$ can be calculated to be -57.0 dBm + 2.0 dB = -55.0 dBm.  This represents the absolute power level of the carrier signal at the mobile phone antenna.  In the 4600A, this translates into setting the Carrier Output Level to be -55.0 dBm.

The other parameters specified in Table 3-1 are implemented by the Base Station Emulator.  The Base Station Emulator is configured to provide the Pilot and Traffic Channels at specific ratios of the total carrier power.  These ratios ($E_c/I_{or}$) are -7.0 dB for the Pilot Channel and -14.7 dB for the Traffic Channel. Setting the various TAS 4600A and Base Station Emulator parameters as described above results in a $E_b/N_t$ ratio of 5.3 dB.

| | TAS 4600A | |
|---|---|---|
| **Configuration** | | |
| Carrier to Noise Units | C/N | |
| Noise Generator Units | - | |
| Interference Source A Status | off | |
| Interference Source B Status | off | |
| Impairments CH1 | off | |
| Impairments CH2 | - | |
| **Channel** | **1** | **2** |
| Carrier Freq. (MHz) | 878.5 | - |
| Emulation Mode | C/N | - |
| Receiver Bandwidth (MHz) | 1.23 | - |
| Carrier to Noise Ratio (dB) | 2.0 | - |
| Bit Rate (bps) | - | - |
| $E_b/N_0$ Ratio (dB) | - | - |
| $C/N_0$ (dB) | - | - |
| C/I (dB) | - | - |
| Noise Power Density (dBm) | - | - |
| Output Level (dBm) | -55.0 | - |
| **Measure** | | |
| Monitor Point | CH1 | |
| # Averages | 16 ($2^4$) | |
| Duty Cycle | 100% | |

**Table 3-4. TAS 4600A Parameter Configuration**

5.  After the TAS 4500 and TAS 4600A are configured, the Base Station Emulator can now be used to setup a data loopback call to the mobile and to perform FER tests.

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## 4.0. REMOTE OPERATION

### 4.1. Overview

A computer or terminal can control the TAS 4600A by issuing commands through the GPIB or RS-232C remote control port.  The TAS 4600A supports three control link protocols:

- RS-232 CR/LF
- RS-232 ACK/NAK
- GPIB

CR/LF (carriage return/line feed) is a simple command-line protocol, and allows you to control TAS 4600A from a dumb terminal or a computer.  In addition to being easiest to implement, the CR/LF protocol provides a convenient way to practice using the 4600A command set.

ACK/NAK is a more sophisticated serial control protocol that includes error-checking and command retransmission.

GPIB (General Purpose Instrumentation Bus) is the industry-standard parallel-bus instrument control protocol.

### 4.2. Remote Control Features

TAS 4600A commands are arranged in functional groups. The following brief descriptions outline the function of each TAS 4600A command group.  For a complete description, refer to Section 5.0. *Command Reference*.

- The CHAN1/CHAN2 command groups are used to setup parameters common to a transmission channel.

- The CNFG command group is used to setup system configuration parameters.

- The FILE command group is used to save and recall standard and user-defined files.

- The MEAS command group is used to make measurements on transmission channel.

## 4.3. Configuring the TAS 4600A for Remote Control

Before you can control TAS 4600A from a remote terminal or computer, you must first set the remote control configuration.  The remote configuration can be set only from the TAS 4600A front panel.  To set the remote control configuration, you must perform the following steps:

1. Verify that the letter 'R' is not present in the upper right corner of the LCD, thus indicating that the unit is in local operation mode.

2. Select the **CONFIG** menu tree.

3. Go to the **Remote Protocol** field.

4. Select the desired protocol (**gpib**, **crlf**, or **acknak**).

5. Enter the submenu of the specified protocol and set the protocol specific options.

6. The 4600A goes into Remote Operation Mode as soon as a command is sent using the selected protocol.

For example, to configure TAS 4600A for RS-232 CR/LF control, select REMOTE PROTOCOL: **crlf**, and press ENTER to select the **crlf** submenu.  Next, set the BAUD RATE, DATA, PARITY, and STOP parameters for the CR/LF protocol.  Figure 4-1 shows the screens used to configure the remote protocol parameters.

```
CONFIG SUBMENU
CRLF REMOTE PROTOCOL
BAUD RATE: 4800
DATA: 7       PARITY: odd       STOP: 1
```

**Figure 4-1. Menu Screen to Configure Remote Protocol Parameters**

For more information on the TAS 4600A CONFIG menu tree, see Section 2.0. *Local Operation*.  For detailed information on each of the TAS 4600A link control protocols, see the "Remote Control Protocol" information in this section.

## 4.4. TAS 4600A Command Protocol

### 4.4.1. Command Types

TAS 4600A supports three distinct types of commands.  These command types are SET commands, REPORT commands, and EXECUTE commands.

SET commands simply assign a value to a TAS 4600A configuration parameter.  If TAS 4600A receives a SET command without a parameter value, it returns the current setting of the parameter.

REPORT commands return a value.  For example, the CNFG command that returns the version number of the firmware is a REPORT command.

EXECUTE commands instruct TAS 4600A to perform an operation.  For example, the GPIB command that disables the front control panel is an EXECUTE command.  EXECUTE commands do not return a value.

### 4.4.2. Command Sequence

To execute a TAS 4600A command, a controller must execute a simple three-step sequence:

1. Check for any pending command response.  TAS 4600A does not execute a new command if the result from a previous command has not been read.
2. Send the command to the TAS 4600A.
3. Read the command response from the TAS 4600A.

### 4.4.3. Command Messages

A TAS 4600A command message consists of one or more command frames. A command frame consists of a command group name and one or more commands.  A slash precedes and follows each command frame.  A colon follows the command group name, and a comma follows each command name except the last command.  TAS 4600A ignores white space within the command frame and characters are not case sensitive.  The command frame has the following syntax:

/command group: command1, command2, ..., commandn/

All of the commands within a command frame must belong to the same command group.  An example of a command group is MEAS:

/MEAS: SEL=CH2, AVG=3/

The above command sets the measurement point to Channel 2, and then sets the power meter averaging factor to 8 ($2^3$).

NOTE: All of the commands in the previous example are SET commands.

An example of a REPORT command is:

/CNFG:MODL/

This command instructs the instrument to report its model number. The response would be:

/CNFG:MODL=4600A/

If TAS 4600A receives a SET command without a parameter value, it returns the current value of the parameter.  For example, the following message tells TAS 4600A to return the value of the power meter averaging factor:

/MEAS: AVG/

The TAS 4600A would respond with the following message:

/MEAS: AVG=3/

An example of an EXECUTE command is:

/FILE: FRCL/

This command tells TAS 4600A to EXECUTE a file recall.

A command message can contain more than one command frame.  For example, the following command message tells TAS 4600A to EXECUTE diagnostics, SET the RESPONSE mode to TERSE, and REPORT the current value of the power meter averaging factor:

/CNFG:DIAG, RESP=TERSE/MEAS:AVG/

A single slash separates the CNFG command group from the MEAS command group.

### 4.4.4. Response Format

TAS 4600A provides an explicit response to each command message that it receives.  A command message can be one of three types:

- Command Completion message
- Value message
- Error message

### Command Completion Message

TAS 4600A returns a command completion message in response to a SET command or EXECUTE command.  The command completion message is:

/C/

### Parameter Value Readback

TAS 4600A returns a value message in response to a REPORT command.  The form of the value message is:

/command group: command=value/

For example, if the controller sends the message

/CHAN1: FC/

TAS 4600A might respond with

/CHAN1: FC=8800/

This response indicates that the carrier frequency parameter to Channel 1 is set to 880.0 MHz.

### Error Message Format

TAS 4600A returns an error message when it detects a problem with command syntax, or when it detects an internal processing error.  The form of the error message is:

/command group: Exxx/

where *xxx* is the error number.

### Response to a Multiple-Command Message

TAS 4600A returns only one response for each command message that it receives. If the command message contains multiple commands, TAS 4600A responds to the last command in the message. If one of the commands in a multiple command message results in an error, TAS 4600A ceases processing the command message and reports the error.

### Terse Responses

If the PROTOCOL RESPONSE MODE is **terse**, TAS 4600A does not include the slashes, command group name, or parameter name in the response.  The following command transactions illustrate the format of terse responses.

Command:     /CNFG: MODL/

Response:     4600A

## 4.5. Transmission Layer Protocols

TAS 4600A provides three remote control protocol options: RS-232 CR/LF, RS-232 ACK/NAK, and GPIB.  The command syntax remains the same, regardless of the remote protocol.  The remote control protocol determines only the method by which TAS 4600A receives commands and provides responses.

### 4.5.1. RS-232C CR/LF Protocol

The TAS 4600A RS-232 CR/LF is the simplest remote control protocol.  You can use this protocol to control TAS 4600A from a data terminal or a computer.  The RS-232 CR/LF protocol does not perform error checking, so you should not use this protocol unless the control terminal or computer is co-located with the TAS 4600A.

TAS 4600A provides a **>** prompt when it is ready to receive a command.  To enter a command, simply type the command, then press CARRIAGE RETURN.  TAS 4600A executes the command and provides a response.  After TAS 4600A provides the response, it sends another **>** prompt to indicate that it is again ready to receive a command.

### 4.5.2. ACK/NAK Protocol

The TAS 4600A ACK/NAK protocol supports RS-232 multipoint communication between a controller and one or more TAS devices.  ACK/NAK also detects command transmission errors, and provides for retransmission of corrupted commands.

The controller initiates all ACK/NAK protocol transactions.  To effect a command transaction with TAS 4600A, the controller must perform the following operations:

- Poll the TAS 4600A for a pending response.
- Send the command to TAS 4600A.
- Poll TAS 4600A for the command response.

The following example illustrates a command transaction between a controller and TAS 4600A.

First, the controller polls for any pending response.  This ensures that the TAS 4600A response buffer is empty so that TAS 4600A can process the next command.
[addr]p<ENQ>

The TAS 4600A response buffer is empty, so it responds:

[addr]<EOT>

Next, the controller sends the command to TAS 4600A:

[addr]s<ENQ><SOH><STX>/METER: AVG=3/<ETX>[checksum]

TAS 4600A receives the command, does not detect any errors, and responds:

[addr]<ACK>

The controller then polls for the response to the command:

[addr]p<ENQ>

TAS 4600A has finished executing the command, so it responds:

[addr]<SOH><STX>/C/<ETX>[checksum]

> **NOTE:** [addr] is the device address.  The address can be any decimal number from 0 to 99.  If the address is less than 10, the controller must left-pad the address with a space.

[checksum] is the message checksum.  The message checksum is a three-digit decimal number.  [checksum] is the two's complement of the module 256 sum of all characters from the first address character through the <ETX> character.  For example, if the checksum is 201, then the block checksum should be 055 (256-201).

<ENQ> is the ASCII INQUIRE control character.

<EOT> is the ASCII END OF TRANSMISSION control character.

<SOH> is the ASCII START OF HEADER control character.

<STX> is the ASCII START OF TEXT control character.

<ETX> is the ASCII END OF TEXT control character.

## Polling the TAS 4600A for a Response

When TAS 4600A receives a command from the controller, it executes the command and prepares a response.  The controller must poll TAS 4600A to receive this response.  The poll sequence is:

[addr]p<ENQ>

The poll message results in one of the following:

- TAS 4600A does not respond.

- TAS 4600A has no response waiting.

  `[addr]<EOT>`

- TAS 4600A provides a response.

  `[addr]<SOH><STX>[response]<ETX>[checksum]`

TAS 4600A does not respond to a poll if one of the following conditions exists:

- The TAS 4600A configuration is not proper.  For example, TAS 4600A does not respond if its ACK/NAK address does not match the address contained in the poll message.

- TAS 4600A is currently processing a command.

- The poll message has been corrupted by an error.

- TAS 4600A AC power is off.

If the controller does not receive a response from TAS 4600A, it should poll again.  TAS 4600A responds with [addr]<EOT> if it has no response pending.

## Sending Commands to the TAS 4600A

To send a command to TAS 4600A, the controller must assemble and send a SELECT message.  The format of the SELECT message is shown below.

[addr]s<ENQ><SOH><STX>[command]<ETX>[checksum]

The select message yields one of three possible results:

- TAS 4600A does not respond to the message.

- TAS 4600A detects an error in the message:

  [addr]<NAK>

- TAS 4600A receives the message and does not detect any errors:

  [addr]<ACK>

TAS 4600A does not respond to the SELECT message if one of the following conditions exists:

- The TAS 4600A address does not match the address contained in the SELECT message.

- TAS 4600A AC power is off.

TAS 4600A responds with a negative acknowledgment (NAK) if it detects a transmission error in the SELECT message (bad checksum), or if the message is too long (greater than 512 characters). If TAS 4600A detects a transmission error in the message, the controller should send the message again.

## Receiving Responses from the TAS 4600A

TAS 4600A provides a command response when it is polled by the controller. If the controller detects a transmission error in the TAS 4600A response, it should perform the following steps:

- Poll TAS 4600A until TAS 4600A responds with [addr]<EOT>.
- Send the message again.
- Poll TAS 4600A again for the response.

## 4.5.3. GPIB Protocol

The TAS 4600A GPIB protocol supports a parallel bus control architecture in which TAS 4600A is one of the devices being controlled. The controller must meet all GPIB electrical and mechanical specifications.

The controller initiates all GPIB protocol transactions. In order to communicate with TAS 4600A, a GPIB controller must perform the following operations:

- Poll TAS 4600A for a pending response.
- Send the message to TAS 4600A.
- Poll TAS 4600A for the command response.

TAS 4600A provides a GPIB status byte to indicate its current state. Possible states include:

- IDLE - 02H
- BUSY - 01H
- READY TO RESPOND (RTR) - 04H or 44H

IDLE indicates that TAS 4600A does not have a message to send and is ready to accept a command.

BUSY indicates that TAS 4600A is currently processing a command.  TAS 4600A does not accept a new command until it has finished processing the current command and has provided the response to the controller.

READY TO RESPOND (RTR) indicates that TAS 4600A currently has a message to send to the controller.  TAS 4600A is always Ready to Respond when it finishes processing a command.

When TAS 4600A is ready to respond, it activates the service request line (SRQ), and sets the RTR status to 44 hex.  After the controller conducts the serial poll, SRQ goes inactive, and TAS 4600A sets the RTR status to 04 hex.

Figure 4-2 shows a flowchart for a typical bus controller sequence.
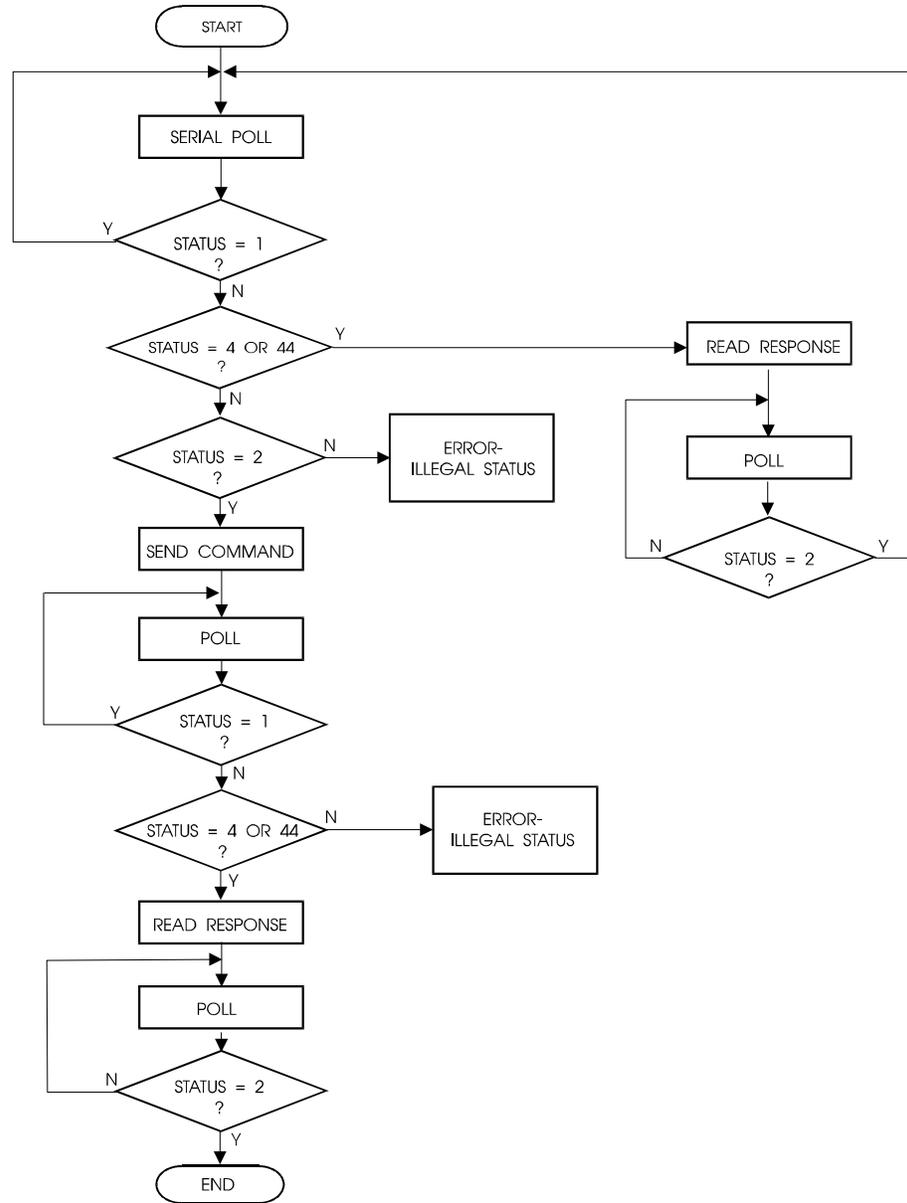
**Figure 4-2.  GPIB Controller Sequence**

## Polling for a Response

The controller must conduct a serial poll to receive a command response from TAS 4600A.  The following example shows the typical GPIB sequence required to achieve a serial poll of TAS 4600A.  Your actual bus sequence may be different:

    a.  ATN active

    b.  UNT - (UNTalk)

    c.  UNL - (UNListen)

    d.  SPE - (Serial Poll Enable)

    e.  MTA - (TAS 4600A My Talk Address)

    f.  Controller programmed to listen

    g.  ATN inactive

    h.  TAS 4600A sends status

    i.  ATN active

    j.  SPD - (Serial Poll Disable)

    k.  UNT - (UNTalk)

Always conduct a serial poll before sending a command to TAS 4600A.  If TAS 4600A has a pending message to send, it does not accept a new command.

## Sending Commands to the TAS 4600A

The following example shows the typical GPIB sequence required to send a command to TAS 4600A.  Your actual bus sequence may be different.

    a.  ATN active

    b.  UNT - (UNTalk)

    c.  UNL - (UNListen)

    d.  MLA - (TAS 4600A My Listen Address)

    e.  Controller programmed to talk

    f.  ATN inactive

    g.  Controller sends command to TAS 4600A and asserts EOI with last command character

    h.  ATN active

    i.  UNL - (UNListen)

Command strings must not be terminated with CARRIAGE RETURN or CARRIAGE RETURN+LINE FEED.  The controller must signal the end of a command message by asserting EOI (end of interrupt) while it sends the last character of the message.

Some commands require several seconds of TAS 4600A processing time.  While TAS 4600A completes most commands in less than 100 msec., some commands may require up to three seconds.  The controller should conduct serial polls until the TAS 4600A status is RTR.

## Receiving Responses from the TAS 4600A

The following example shows the typical GPIB sequence required to receive a command from TAS 4600A.  Your actual bus sequence may be different.

    a.   ATN active

    b.   UNT - (UNTalk)

    c.   UNL - (UNListen)

    d.   MTA - (TAS 4600A My Talk Address)

    e.   Controller programmed to listen

    f.   ATN inactive

    g.   TAS 4600A sends data to controller

    h.   Controller reasserts control when EOI goes active

    i.   ATN active

    j.   UNT - (UNTalk)

TAS 4600A does not terminate its response message with a CARRIAGE RETURN or CARRIAGE RETURN+LINE FEED.  TAS 4600A signals the end of a response message by raising EOI while it sends the last character of the response.

This section is designed to help those who are already familiar with the TAS 4600A command set to easily find and use commands. The TAS 4600A Parameter Reference provides a complete description of each command group and all commands within each group.

The user should be thoroughly familiar with Section 4.0. "*Remote Operation*", before attempting to use the TAS 4600A remote commands. The "Remote Operation" section provides the details of the TAS 4600A command message format and syntax.

## 5.1. Conventions to Specify Commands

The TAS 4600A commands are divided into three types: SET, REPORT, and EXECUTE. In section 5.2, "*Command Summary*,"  the type of each command is indicated by the column labeled "Type."

SET commands are issued to the TAS 4600A in the format:

`/command group:parameter=setting/`

The TAS 4600A will respond to a legal SET command with the response:

`/C/`

REPORT commands require the format:

`/command group:name/`

The TAS 4600A will provide the requested information as:

`/command group:name=response/`

where `response` can be more than one value separated by commas. All SET commands respond like REPORT commands if "`=setting`" is left out. The returned value is the current setting of the parameter.

EXECUTE commands require the format:

`/command group:command/`

If the command is successful, the TAS 4600A will respond with:

`/C/`

## 5.2. Command Summary

CHAN1: or CHAN2:

| Name | Description | Data Range | Type | Default |
|------|-------------|------------|------|---------|
| AUTOSET | Calibrate the Selected Carrier to Noise Ratio or Carrier to Interferer Ratio | None | EXEC | |
| BRATE | Set Bit Rate when $E_BN_0$ Units are selected | 100 to 20,000,000 bps | SET | 9600 |
| BYPASS | Engage or disengage Channel Bypass. | ON, OFF | SET | OFF |
| CIR | Set Carrier to Interferer Ratio | -900 to +600 (-90.0 to +60.0) | SET | 0 |
| CNDR | Set $C/N_0$ (Carrier to Noise Density Ratio) when $CN_0$ Units are selected | 100 to 1100 (10.0 to 110.0 dBHz) | SET | 599 |
| CNR | Set the C/N (Carrier to Noise Ratio) when CN Units are selected | -400 to 600 (-40.0 to 60.0 dB) | SET | -100 |
| CST | Set status of channel carrier | ON, OFF | SET | ON |
| EBNDR | Set $E_b/N_0$ (Energy per Bit to Noise Density Ratio) when EBN0 Units are selected | -200 to +800 (-20.0 to +80.0 dB) | SET | 201 |
| FC | Set Channel Carrier Frequency | TAS 4600AE:  8200 to 9600 (820.0-960.0 MHz)  17000 to 20000 (1700.0 to 2000.0 MHz)  TAS 4600AH:  17000 to 25000 (1700.0 to 2500.0 MHz) | SET | 8800 or 19400 |
| MEAS | Report measured C/N, $C/N_0$, $E_b/N_0$, or C/I ratio. | None | RPT | |
| MODE | Set mode of emulation | CTON, CTOI, NSG, IG, AT | SET | CTON |
| NBPWR | Set noise output power when dBm Noise Generator units are selected. | -1600 to -140 -160.0 to -14.0 dBm | SET | -600 |
| NSLVL | Set noise power density when dBm/Hz Noise Generator units are selected. | -2000 to -900 -200.0 to -90.0 dBm/Hz | SET | -1000 |
| NST | Set status of channel impairments. | ON, OFF | SET | ON |
| OPER | Report if channel is currently operating | None | RPT | |
| PLVL | Set power level of carrier signal at RF output | -12000 to -500 (-120.00 to -5.00 dBm) | SET | -4000 |
| RBW | Set Receiver Bandwidth when CN Units are selected or when dBm Noise Generator Units are selected. | 1 to 4000 (0.01-40.00 MHz) | SET | 123 |

## System Configuration **CNFG:**

| Name | Description | Data Range | Type | Default |
|------|-------------|------------|------|---------|
| CNUNITS | Set the units for carrier to noise (CTON) mode | CN (C/N), EBN0 ($E_b/N_0$), CN0 ($C/N_0$) | SET | CN |
| CST1 | Set status of Channel 1 carrier | ON, OFF | SET | ON |
| CST2 | Set status of Channel 2 carrier | ON, OFF | SET | ON |
| CWFRQA | Set the frequency of CW Source A | T4600-DINT option 80000 to 100000 800.00 to 1000.00 MHz 170000 to 200000 1700.00 to 2000.00 MHz<br><br>T4600-DINTM option 86500 to 89800 865.00 to 898.00 MHz 192800 to 199200 1928.00 to 1992.00 MHz | SET | 88090 |
| CWFRQB | Set the frequency of CW Source B | T4600-DINT option 80000 to 100000 800.00 to 1000.00 MHz 170000 to 200000 1700.00 to 2000.00 MHz<br><br>T4600-DINTM option 86500 to 89800 865.00 to 898.00 MHz 192800 to 199200 1928.00 to 1992.00 MHz | SET | 88170 |
| DIAG | Perform Diagnostics | None | EXEC | |
| ISRCA | Set Interference Source A Status | INTCW, EXT, OFF | SET | OFF |
| ISRCB | Set Interference Source B Status | INTCW, EXT, OFF | SET | OFF |
| LCD | Set LCD contrast | 0-10 | SET | 3 |
| LOC | Enable Local Control (Enter Local) | None | EXEC | |
| MODL | Report System Model Number | None | RPT | |
| NST1 | Set status of Channel 1 impairments | ON, OFF | SET | ON |
| NST2 | Set status of Channel 2 impairments | ON, OFF | SET | ON |
| NSUNITS | Set the units for noise generator (NSG) mode. | DBM, DBMPHZ (dBm/Hz) | SET | DBM |
| PLVLO1 | Set CH1 Carrier Output Power Offset | -25 to 25, -2.5 to +2.5 dB | SET | 0 |
| PLVLO2 | Set CH2 Carrier Output Power Offset | -25 to 25, -2.5 to +2.5 dB | SET | 0 |
| PVER | Report Power Meter Version Number | None | RPT | |
| REM | Enable Remote Control (Enter Remote) | None | EXEC | |
| RESP | Sets the remote response format | VERBOSE, TERSE | SET | Verbose |
| SCV | Report System Controller Version Number | None | RPT | |
| STAT | Report Last Error Status (Diagnostics Status) | None | RPT | |
| SYS | Report System Configuration | None | RPT | |

## File Save & Recall **FILE:**

| Name | Description | Data Range | Type | Default |
|------|-------------|------------|------|---------|
| FNAM | Set File Name | DEFAULT<br>FDEFAULT<br>FILE0<br>FILE1<br>FILE2<br>FILE3<br>FILE4<br>IS97_AWGN<br>IS98_AWGN<br>IS97_FADE<br>IS98_FADE<br>IS97_DESENS<br>IS98_DESENS | SET | Default |
| FRCL | Recall File With Current Name (See FNAM) | None | EXEC | |
| FSAV | Save File To Current Name | None | EXEC | |

## Power Meter MEAS:

| Name | Description | Data Range | Type | Default |
|------|-------------|------------|------|---------|
| AVG | Set # of averages on power meter. | 0 - 8 (represents 2^n averages) | SET | 0 |
| DC | Set Duty Cycle of input signal | 0 to 100 (%) | SET | 100 |
| FAST | Perform fast measurements | ON, OFF | SET | OFF |
| PMZERO | Perform power meter zero operation. | None | EXEC | |
| SEL | Select Measurement Source | None, CH1, CH2<br>(Channel 1 or Channel 2 input power levels) | SET | CH1 |
| VALUE | Report measured power of input. | None | RPT | |

## 5.3. Command Descriptions

All commands summarized in the previous section 5.2 "*Command Summary*" will be described in detail in this section.

### 5.3.1. Channel 1 & Channel 2 Configuration (CHAN1 & CHAN2)

**Command Group Format:**

/CHAN1:command(s)/  or  /CHAN2:command(s)/

**Command Group Description:**

The CHAN1 and CHAN2 command groups allow the user to configure channel settings of the TAS 4600A. The CHAN1 command group controls settings of channel 1 of the TAS 4600A while the CHAN2 command group controls settings of the channel 2 setting if the system is equipped with a second channel.

**Commands:**

AUTOSET, BRATE, BYPASS, CIR, CNDR, CNR, CST, EBNDR, FC, MEAS, MODE, NBPWR, NSLVL, NST, OPER, PLVL, RBW

Perform an Autoset (AUTOSET)

**Command Description:**

Performs an Autoset operation on the channel selected.  See the Local Operation Section for more details on the Autoset operation.

**Valid Command Data:**

None

**Example:**

To Autoset channel 1:

/CHAN1:AUTOSET/

**Expected Response:**

If the Autoset is successful:

/C/

## Bit Rate (BRATE)

**Command Description:**

Sets the Bit Rate when EBN0 Units are selected.

**Valid Command Data:**

Range: 100 to 20,000,000 bps

**Example:**

To set the Bit Rate to 9600 on channel 1:

/CHAN1:BRATE=9600/

**Expected Response:**

/C/

## Set the Channel Bypass (BYPASS)

**Command Description:**

Engages or disengages the channel bypass feature.

**Valid Command Data:**

Range: ON – Activate Bypass

OFF – Deactivate Bypass

**Example:**

To bypass Channel 1:

/CHAN1:BYPASS=ON/

**Expected Response:**

/C/

Carrier to Interference Ratio (CIR)

**Command Description:**

Sets the C/I ratio when the Carrier to Interference (CTOI) mode is selected.

**Valid Command Data:**

Range: -900 to 600 (-90.0 to +60.0 dB)

**Example:**

To set the C/I ratio to -72.0 dB on Channel 1:

/CHAN1:CIR=-720/

**Expected Response:**

/C/

C/$N_0$ Ratio (CNDR)

**Command Description:**

Sets the C/$N_0$ ratio when CN0 Units are selected.

**Valid Command Data:**

Range: 100 to 1100 (10.0 to 110.0 dBHz)

**Example:**

To set the C/$N_0$ ratio to 61.9 dBHz on Channel 1:

/CHAN1:CNDR=619/

**Expected Response:**

/C/

## Carrier to Noise Ratio (CNR)

**Command Description:**

Sets the C/N (Carrier to Noise Ratio) when CN (C/N) Units are selected.

**Valid Command Data:**

Range: -400 to 600 (-40.0 to +60.0 dB)

**Example:**

To set the channel 1 carrier to noise ratio to -1.0 dB:

/CHAN1:CNR=-10/

**Expected Response:**

/C/

## Channel Carrier Status (CST)

**Command Description:**

Set the carrier status of a channel.  When set to OFF carrier is terminated.

**Valid Command Data:**

Range: ON - Enable carrier on the channel

OFF - Disable carrier on the channel

**Example:**

To disable carrier on Channel 1:

/CHAN1:CST=OFF/

**Expected Response:**

/C/

## $E_b/N_0$ Ratio (EBNDR)

**Command Description:**

Sets the $E_b/N_0$ ratio when EBN0 Units are selected.

**Valid Command Data:**

Range: -200 to +800 (-20.0 to +80.0 dB)

**Example:**

To set the $E_b/N_0$ ratio to 21.1 dB on Channel 1:

/CHAN1:EBNDR=211/

**Expected Response:**

/C/

## Carrier Frequency (FC)

**Command Description:**

Sets the carrier frequency for the specific channel.

**Valid Command Data:**

Range for TAS 4600AE: 8200 to 9600 and 17000 to 22000
(820.0 to 960.0 MHz and 1700.0 to 2200. MHz)

Range for TAS 4600AH: 17000 to 25000 (1700.0 to 2500.0 MHz)

**Example:**

To set channel 1 carrier frequency to 880.0 MHz.

/CHAN1:FC=8800/

**Expected Response:**

/C/

## Report the Measured C/N, $C/N_0$, $E_b/N_0$, or C/I Ratio (MEAS)

**Command Description:**

Reports the current measured C/N, $C/N_0$, $E_b/N_0$, or C/I ratio on the specified channel.

**Valid Command Data:**

None

**Example:**

To check the current measured ratio on channel 1:

/CHAN1:MEAS/

**Expected Response:**

/CHAN1:MEAS=-1.0/

The above response would indicate the current ratio measured on channel 1 was -1.0 dB.  The units of the response will be consistent with those selected by the /CNFG:CNUNITS/ command.

## Emulation Mode (MODE)

**Command Description:**

Set the emulation mode of the specified channel.

**Valid Command Data:**

Range: CTON (Carrier-to-Noise),

CTOI (Carrier-to-Interference),

NSG (Noise Generator),

IG (Interference Generator – if equipped)

AT (Carrier Attenuator)

**Example:**

To set the emulation mode to carrier-to-noise on Channel 1.

/CHAN1:MODE=CTON/

**Expected Response:**

/C/

## Set the Noise Signal Bandpower (NBPWR)

**Command Description:**

Sets the noise power in a band when dBm Noise Generator units are selected. The bandwidth, over which the noise power is specified, is defined by the Receiver Bandwidth (RBW) command.

**Valid Command Data:**

Range: -1600 to -140 (-160.0 to -14.0 dBm)

**Example:**

To set the output noise power to -90.0 dBm on channel 1:

/CHAN1:NBPWR=-900/

**Expected Response:**

/C/

## Set the Noise Signal Output Density (NSLVL)

**Command Description:**

Sets the noise power density when dBm/Hz Noise Generator units are selected.

**Valid Command Data:**

Range: -2000 to -900 (-200.0 to -90.0 dBm/Hz)

**Example:**

To set the output noise density to -90.0 dBm/Hz on Channel 1:

/CHAN1:NSLVL=-900/

**Expected Response:**

/C/

## Channel Impairment Status (NST)

**Command Description:**

Set the impairment status of a channel.  When set to OFF all impairments are bypassed.

**Valid Command Data:**

Range: ON - Enable impairments on the channel

OFF - Disable impairments on the channel

**Example:**

To disable impairments on Channel 1:

/CHAN1:NST=OFF/

**Expected Response:**

/C/

## Report Channel Operation Status (OPER)

**Command Description:**

Reports the current operational status of the specified channel.

**Valid Command Data:**

None

**Example:**

To check the Operational Status of channel 1:

/CHAN1:OPER/

**Expected Response:**

If the channel is in OPERATING mode:

/CHAN1:OPER=ON/

If the channel is not in OPERATING mode:

/CHAN1:OPER=OFF/

## Set the Carrier Signal Output Power Level (PLVL)

**Command Description:**

Sets the output power level of the carrier signal on the specified channel.

**Valid Command Data:**

Range: -12000 to -500 (-120.00 to -5.00 dBm)

**Example:**

To set the output power level of the carrier signal to -30.00 dBm on Channel 1:

/CHAN1:PLVL=-3000/

**Expected Response:**

/C/

## Receiver Bandwidth (RBW)

**Command Description:**

Sets the Receiver Bandwidth for use when CN (C/N) units are selected.

**Valid Command Data:**

Range: 1 to 4000 (0.01 to 40.00 MHz)

**Example:**

To change the channel 2 Receiver Bandwidth to 1.23 MHz:

/CHAN2:RBW=123/

**Expected Response:**

/C/

## 5.3.2. System Configuration (CNFG)

### Command Group Format:

/CNFG:command(s)/

### Command Group Description:

The CNFG command group allows the user to query, execute and select different system configuration settings.

### Commands:

CNUNITS, CST1, CST2, CWFRQA, CWFRQB, DIAG, ISRCA, ISRCB, LCD, LOC, MODL, NST1, NST2, NSUNITS, PLVLO1, PLVLO2, PVER, REM, RESP, SCV, STAT, SYS

## Carrier to Noise Units (CNUNITS)

### Command Description:

Set the units for carrier to noise (CTON) mode

### Valid Command Data:

Range: CN (C/N), EBN0 ($E_b/N_0$), CN0 ($C/N_0$)

### Example:

To set carrier to noise units to $E_b/N_0$.

/CNFG:CNUNITS=EBN0/

### Expected Response:

/C/

## Channel 1 Carrier Status (CST1)

**Command Description:**

Set the carrier status of Channel 1.  When set to OFF carrier is terminated. Note that CHAN1:CST has the same function.

**Valid Command Data:**

Range: ON - Enable carrier on Channel 1

OFF - Disable carrier on Channel 1

**Example:**

To disable carrier on Channel 1:

/CNFG:CST1=OFF/

**Expected Response:**

/C/

## Channel 2 Carrier Status (CST2)

**Command Description:**

Set the carrier status of Channel 2.  When set to OFF carrier is terminated. Note that CHAN2:CST has the same function.

**Valid Command Data:**

Range: ON  - Enable carrier on Channel 2

OFF - Disable carrier on Channel 2

**Example:**

To disable carrier on Channel 2:

/CNFG:CST2=OFF/

**Expected Response:**

/C/

CW Source A Frequency (CWFRQA)

**Command Description:**

Sets the frequency of CW Source A.

**Valid Command Data:**

T4600-DINT option
Range: 80000 to 10000 (800.00 to 1000.00 MHz)

170000 to 200000 (1700.00 to 2000.00 MHz)


T4600-DINTM option
Range: 86500 to 89800 (865.00 to 898.00 MHz)

192800 to 199200 (1928.00 to 1992.00 MHz)


> **NOTE:** Range may vary according to RF options present. Consult Section 7 *Technical Specifications* for your model 4600A to confirm the valid range supported.

**Example:**

To set the frequency of CW Source A to 880.00 MHz.

/CNFG:CWFRQA=88000/

**Expected Response:**

/C/

## CW Source B Frequency (CWFRQB)

**Command Description:**

Sets the frequency of CW Source B.

**Valid Command Data:**

T4600-DINT option
Range: 80000 to 10000 (800.00 to 1000.00 MHz)

170000 to 200000 (1700.00 to 2000.00 MHz)

T4600-DINTM option
Range: 86500 to 89800 (865.00 to 898.00 MHz)

192800 to 199200 (1928.00 to 1992.00 MHz)

> **NOTE:** Range may vary according to RF options present.  Consult Section 7 *Technical Specifications* for your model 4600A to confirm the valid range supported.

**Example:**

To set the frequency of CW Source B to 880.00 MHz.

/CNFG:CWFRQB=88000/

**Expected Response:**

/C/

## System Diagnostics (DIAG)

**Command Description:**

Performs a self-test and reports system diagnostics. If the system encounters an error during the diagnostic, the system error will be returned. For more information on system errors, see section 6.0. for a listing of the error codes.

**Valid Command Data:**

None

**Example:**

To perform a system diagnostic:

/CNFG:DIAG/

**Expected Response:**

If no error is encountered during the diagnostic:

/C/

## Interference Source A Status (ISRCA)

**Command Description:**

Set the status of Interference Source A for use when in Carrier to Interference (CTOI) or Interference Generator (IG) modes.

**Valid Command Data:**

Range: INTCW - Enable internal CW interference source (if equipped)

EXT - Enable external interference source

OFF - Disable Interference Source A

**Example:**

To disable Interference Source A:

/CNFG:ISRCA=OFF/

**Expected Response:**

/C/

## Interference Source B Status (ISRCB)

**Command Description:**

Set the status of Interference Source B for use when in Carrier to Interference (CTOI) or Interference Generator (IG) modes.

**Valid Command Data:**

Range: INTCW  - Enable internal CW interference source (if equipped)

EXT - Enable external interference source

OFF - Disable Interference Source B

**Example:**

To disable Interference Source B:

/CNFG:ISRCB=OFF/

**Expected Response:**

/C/

## Set the LCD Contrast (LCD)

**Command Description:**

Sets the contrast for the 40x4 Liquid Crystal Display.

**Valid Command Data:**

Range: 0 to 10

**Example:**

To set the contrast to an average setting.

/CNFG:LCD=5/

**Expected Response:**

/C/

## Local Control (LOC)

**Command Description:**

Puts the system into local (front panel) control mode.

**Valid Command Data:**

None

**Example:**

/CNFG:LOC/

**Expected Response:**

/C/

## Query System Model Number (MODL)

**Command Description:**

Reports the system model number.

**Valid Command Data:**

None

**Example:**

/CNFG:MODL/

**Expected Response:**

/CNFG:MODL=4600A/

## Channel 1 Impairment Status (NST1)

**Command Description:**

Set the impairment status of Channel 1.  When set to OFF all impairments are bypassed.  Note that CHAN1:NST has the same function.

**Valid Command Data:**

Range: ON - Enable impairments on Channel 1

OFF - Disable impairments on Channel 1

**Example:**

To disable impairments on Channel 1:

/CNFG:NST1=OFF/

**Expected Response:**

/C/

## Channel 2 Impairment Status (NST2)

**Command Description:**

Set the impairment status of Channel 2.  When set to OFF all impairments are bypassed.  Note that CHAN2:NST has the same function.

**Valid Command Data:**

Range: ON  - Enable impairments on Channel 2

OFF - Disable impairments on Channel 2

**Example:**

To disable impairments on Channel 2:

/CNFG:NST2=OFF/

**Expected Response:**

/C/

## Noise Source Units (NSUNITS)

**Command Description:**

Set the units for noise generator (NSG) mode.

**Valid Command Data:**

Range: DBM, DBMPHZ (dBm/Hz)

**Example:**

To set the noise generator units to dBm.

/CNFG:NSUNITS=DBM/

**Expected Response:**

/C/

## Set the Carrier Signal Output Power Level Offset (PLVLO1 and PLVLO2)

**Command Description:**

Sets the carrier signal output power level offset on the specified channel. PLVLO1 sets the offset for Channel 1. PLVLO2 sets the offset for Channel 2.

**Valid Command Data:**

Range: -25 to +25 (-2.5 to +2.5 dB)

**Example:**

To set the output power level offset to -1.0 dB on Channel 1:

/CNFG:PLVLO1=-10/

**Expected Response:**

/C/

## Power Meter Version Number (PVER)

**Command Description:**

Reports the version number of the internal power meter.

**Valid Command Data:**

None

**Example:**

/CNFG:PVER/

**Expected Response:**

/CNFG:PVER=1.05/

## Remote Control (REM)

**Command Description:**

Puts the system into remote (RS-232 or GPIB) control mode.

**Valid Command Data:**

None

**Example:**

/CNFG:REM/

**Expected Response:**

/C/

## Response Format (RESP)

**Command Description:**

Sets the remote response format to either verbose or terse. If the RESP format is TERSE, TAS 4600A does not include the slashes, command group name, or parameter name in the response. The default value for RESP format is VERBOSE.

**Valid Command Data:**

VERBOSE: Causes the TAS 4600A to use its usual command response format as shown in the following example.

> Command:     /CNFG:MODL/
>
> Response:     /CNFG:MODL=4600A/

TERSE: Causes the TAS 4600A to use the terse command response format shown in the following example:

> Command:     /CNFG:MODL/
>
> Response:     4600A

**Example:**

To set remote response format to TERSE:

/CNFG:RESP=TERSE/

**Expected Response:**

/C/

## System Controller Version Number (SCV)

**Command Description:**

Reports the system controller processor firmware version number.

**Valid Command Data:**

None

**Example:**

/CNFG:SCV/

**Expected Response:**

/CNFG:SCV=1.30/

## Diagnostics Status (STAT)

**Command Description:**

Reports the system status or the last diagnostics performed.

**Valid Command Data:**

None

**Example:**

/CNFG:STAT/

**Expected Response:**

/CNFG:STAT=ok/

## Query System Configuration (SYS)

**Command Description:**

Reports the system's configuration.

**Valid Command Data:**

The system configuration information is encoded into a 32 digit string.  The following list explains each of the digit assignments.

| Digit # | Description |
|---------|-------------|
| 0 | # of channels in system = 0, 1, or 2 |
| 1-3 | reserved for future use |
| 4 | Channel #1 - filter #1 type: <br> 0 = none <br> 1 = 800 to 1000 MHz <br> 2 = 1700 to 2000 MHz <br> 3 = 1700 to 2200 MHz <br> 4 = 2200 to 2500 MHz |
| 5 | Channel #1 - filter #2 type |
| 6 | Channel #2 - filter #1 type |
| 7 | Channel #2 - filter #2 type |
| 8-11 | Reserved for future use |
| 12 | Output attenuator #1 type <br> 0 = none <br> 1 = 0 to 60 dB, 0.1 dB resolution (Pin Diode) <br> 2 = 0 to 60 dB, 0.25 dB resolution <br> 3 = 0 to 60 dB, 0.1 dB resolution |
| 13 | Output attenuator #2 type |
| 14-17 | Reserved for future use |
| 18 | CW type: <br> 0 = none <br> 1 = 800-1000 MHz  & 1700-2000 MHz <br> (10 kHz resolution) <br> 2 = 865-898 MHz  & 1928-1992 MHz <br> (10 kHz resolution) |
| 19 | Channel Bypass: <br> 0 = none <br> 1 = present |
| 20 | Internal Duplexer <br> 0 = none <br> 1 = present |
| 21-31 | Reserved for future use |

**Example:**

/CNFG: SYS/

**Expected Response:**

/CNFG: SYS= 200012120000220000011000000000000/

---

**NOTE**: Digit 0 is to the left.

---

This response would indicate the unit was equipped with the following features:

- 2 RF channels are present in the system (Digit 0)
- CH1 Filter Type 1 is 800 to 1000 MHz (Digit 4)
- CH1 Filter Type 2 is 1700 to 2000 MHz (Digit 5)
- CH2 Filter Type 1 is 800 to 1000 MHz (Digit 6)
- CH2 Filter Type 2 is 1700 to 2000 MHz (Digit 7)
- The 0.25 dB resolution Output Attenuator is present on CH1 (Digit 12)
- The 0.25 dB resolution Output Attenuator is present on CH2 (Digit 13)
- The optional internal CW interferers are not present (Digit 18)
- The Channel Bypass option is present (Digit 19)
- The optional Duplexer is present (Digit 20)

## 5.3.3. File Save & Recall (FILE)

### Command Group Format:

/FILE:command(s)/

### Command Group Description:

The FILE command group allows the user to save system configurations to a user file or recall system configurations from a read-only file or predefined user file.

### Commands:

FNAM, FRCL, FSAV

## File Name (FNAM)

### Command Description:

Selects the file name of the file to be saved or recalled. For the configurations of the predefined read-only files, see section 8.1 "*Appendix 1: Standard Test and Factory Default Profiles*". Note that this command only sets the file name of the file to be used; no actual save or recall action is executed. To perform a file save or recall, the commands FSAV and FRCL are used. The FSAV and FRCL commands are described in the following sections.

### Valid Command Data:

| | |
|---|---|
| DEFAULT | Same as FDEFAULT. |
| FDEFAULT | System factory default configuration (read-only). |
| FILE0-FILE4 | User defined files (read/write). |

*The following files are available in TAS 4600A and 4600AE systems only:*

| | |
|---|---|
| IS97_AWGN | IS-97A  CDMA Tests with AWGN (read-only). |
| IS98_AWGN | IS-98A  CDMA Tests with AWGN (read-only) |
| IS97_FADE | IS-97A  CDMA Tests with AWGN and Fading (read-only). |
| IS98_FADE | IS-98A  CDMA Tests with AWGN and Fading (read-only). |
| IS97_DESENS | IS-97A  CDMA Receiver Desensitization Tests (read-only). |
| IS98_DESENS | IS-98A  CDMA Receiver Desensitization Tests (read-only). |

### Example:

To set the file name to the system default file:

/FILE:FNAM=FDEFAULT/

### Expected Response:

/C/

## File Recall (FRCL)

**Command Description:**

Performs a file recall with current file defined by the command FNAM. See section 5.3.3 for details on the FNAM command.

**NOTE:** The five user files, file0 - file4, must be predefined first before they can be recalled. i.e. a configuration has to be saved to the user files before they can be recalled.

**Valid Command Data:**

None

**Example:**

/FILE:FRCL/

**Expected Response:**

/C/

## File Save (FSAV)

**Command Description:**

Performs a file save with current file defined by the command FNAM. See section 5.3.3 for details on the FNAM command.

**NOTE:** A file save operation can only be performed on the user (read/write) files - file0 to file4. Any attempt to save the system configuration to a read-only predefined standard file will result in an error.

**Valid Command Data:**

None

**Example:**

/FILE:FSAV/

**Expected Response:**

/C/

### 5.3.4. Measure (MEAS)

**Command Group Format:**

/MEAS:command(s)/

**Command Group Description:**

The measure command group configures the internal power meter for making measurements.

**Commands:**

AVG, DC, FAST, PMZERO, SEL, VALUE

## Sets the Amount of Power Meter Averaging (AVG)

**Command Description:**

Sets the number of averages the power meter will take before responding with a measurement.

**Valid Command Data:**

Range: $n = 0$ to 8  (# of averages = $2^n$)
  8 = auto-averaging

The following table provides a suggested number of averages when the input signal is a single-path Rayleigh faded signal.

| Speed | Doppler @ 878.5 MHz | # Averages |
|-------|---------------------|------------|
| 100 km/hr | 81.4 | 16 |
| 50 km/hr | 40.7 | 32 |
| 30 km/hr | 24.4 | 64 |
| 8 km/hr | 6.5 | 128 |
| 4 km/hr | 3.3 | 128 |

**NOTE:** Auto-averaging is **not** recommended for Rayleigh faded signals.

**Example:**

To set the number of power meter averages to 8 ($2^3$):

/MEAS:AVG=3/

**Expected Response:**

/C/

## Sets the Power Meter Duty Cycle Factor (DC)

**Command Description:**

Sets the duty cycle factor used by the internal power meter to calculate the power of the input signal.

**Valid Command Data:**

Range: 1 to 100 (%)

**Example:**

To set the duty cycle factor to 33%

/MEAS:DC=33/

**Expected Response:**

/C/

## Fast Measurement (FAST)

**Command Description:**

The FAST command performs Autoset operations faster when carrier-to-noise and carrier-to-interference modes have been selected. Real-time updating of the measured values is not available when fast measurements have been selected.

**Valid Command Data:**

ON or OFF

**Example:**

To turn on fast measurements:

/MEAS:FAST=ON/

**Expected Response:**

/C/

## Perform Power Meter Zero (PMZERO)

**Command Description:**

Enables the internal power meter to be zeroed. This eliminates sources of thermal drift in the meter. See the Local Operation Section for further details on the zeroing procedure.

**Valid Command Data:**

None

**Example:**

To zero the internal power meter send the following command:

/MEAS:PMZERO/

**Expected Response:**

If the power meter zeroing is successful:

/C/

## Select Measurement Source (SEL)

**Command Description:**

The SEL command lets the user select the source on which the measurement is to be performed.

**Valid Command Data:**

CH1 - Channel 1 input power level

CH2 - Channel 2 input power level

**Example:**

To set the source of the measurement to the channel 1 input:

/MEAS:SEL=CH1/

**Expected Response:**

/C/

## Report Measurement (VALUE)

**Command Description:**

Performs a measurement on the source specified by the SEL command and reports the value. The SEL command is described in detail in the previous section 5.3.4 "*Select Measurement Source*."

**Valid Command Data:**

None

**Example:**

To take a power level measurement on the channel 2 input.

/MEAS:SEL=CH2,VALUE/

**Expected Response:**

/MEAS:VALUE=-300/

The above response indicates that the carrier power measured at the input of Channel 2 was -30.0 dBm.

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## 6.0. ERROR CODES

The TAS 4600 provides error codes to indicate its current state of operation. Error conditions are reported on the front panel and the remote control (GPIB or RS-232) interfaces. For more information on reading error codes, see the CNFG command group in section 5.0. "*Remote Commands Reference*".

| Error Code | Description |
|---|---|
| 000 | TAS 4600 OK |
| 001 | Command value error |
| 002 | Command syntax error |
| 003 | Command group syntax error |
| 004 | Command failure |
| 005 | Undefined command group |
| 006 | Undefined command |
| 007 | File recall operation failed |
| 008 | Reserved |
| 009 | Reserved |
| 010 | Reserved |
| 011 | Database failure |
| 012 | Reserved |
| 013 | EPROM checksum failed |
| 014 | Reserved |
| 015 | Reserved |
| 016 | Reserved |
| 017 | Reserved |
| 018 | Reserved |
| 019 | Remote Command ignored when in local mode |
| 020-021 | Reserved |
| 022 | Power Meter Communications Error |

| **Error Code** | **Description** |
| --- | --- |
| 023 | Autoset: Output Level Out of Range |
| 024 | Autoset: C/N Ratio Out of Range |
| 025 | Autoset: Input Power Level Too High |
| 026 | Autoset: Input Power Level Too Low |
| 027 | External Interference Level Out of Range |
| 028 | Calibration Tone Out of Range |
| 029 | CH1 Noise Density Too Low |
| 030 | CH2 Noise Density Too Low |
| 031 | CH1 Invalid Frequency Range |
| 032 | CH2 Invalid Frequency Range |
| 033-034 | Reserved |
| 35 | Insufficient Hardware Configuration for Desired File Recall |

## 7.0. TECHNICAL SPECIFICATIONS

The following specifications describe performance over the temperature range 0-50 degrees C and include a 30-minute warm-up time from ambient conditions. All specifications are measured at 880 MHz and 1940 MHz unless stated otherwise. *Italicized* parameters indicate typical performance.

### 7.1. Carrier Path

| | |
|---|---|
| Number of Independent RF Carrier Channels | 1 or 2 |
| Number of Programmable Frequency Bands | 2 per channel |

RF Carrier Frequency Range

| | |
|---|---|
| TAS 4600A | 820-960 MHz |
| | 1.7-2.0 GHz |
| TAS 4600AE | 820-960 MHz |
| | 1.7-2.2 GHz |
| TAS 4600AH | 1.7-2.5 GHz |

| | |
|---|---|
| *Group Delay Variation* | < 1 ns |

*Channel Amplitude Variation Relative to Nominal Insertion Loss*

| | |
|---|---|
| 1.23 MHz bandwidth | +/- 0.05 dB |
| 40 MHz bandwidth | +/- 0.25 dB |

| | |
|---|---|
| *Channel-to-Channel Isolation Measured in C/N mode* | > 100 dB |

#### Input Port

| | |
|---|---|
| Input Range | -50 dBm to 0 dBm |
| *Maximum Safe Input Power* | +20 dBm |
| Accuracy of carrier power measurement | +/- 0.5 dB |
| *VSWR* | < 1.5:1 |
| *Input Impedance* | 50 ohms |
| Connector | N-type |

## Output Port

Amplitude Resolution                                      0.25 dB

Output Level Range
    Minimum Power                            -120 dBm
    Maximum Power                         input level – 7 dB

Carrier Output Level Accuracy           +/- 1.0 dB

Connector                                 N-type

## Secondary Output Port (OUT 2)

Insertion loss from duplex port to secondary output  12.5 +/- 2.5 dB

## 7.2. Noise Generation

AWGN Source
   Number of Sources                           1 per channel
   Frequency range of noise source
      TAS 4600A                                820-960 MHz
                                               1.7-2.0 GHz

      TAS 4600AE                               820-960 MHz
                                               1700-2200 MHz

      TAS 4600AH                               1700-2500 MHz

   Amplitude Resolution                        0.1 dB

   *Crest Factor*                              > 18dB

### Noise Generator Mode

Maximum Noise Power
   820-960 MHz (TAS 4600AE)                    > -98 dBm/Hz
   1700-2200 MHz                               > -100 dBm/Hz
   2200-2500 MHz (TAS 4600AH)                  > -102 dBm/Hz

Absolute Accuracy of Noise Power               +/- 1.0dB

### Carrier-To-Noise Mode

C/N Power Ratio Range
   Minimum C/N power ratio                     -30 dB
   Maximum C/N power ratio                     +60 dB

The achievable C/N power ratio, is a function of the input power level of the carrier signal, the desired output power level of the carrier signal, and the maximum available noise power.  For additional information on range calculation, refer to TASKIT/4600 PC software.

C/N Ratio Resolution                           0.10 dB

*C/N Ratio Accuracy*                           *+/- 0.2 dB*

## 7.3. Interference Generation

Signal Type                                             programmable, 2 independent
                                                        CW tones

Frequency Offset from Carrier                           programmable

Frequency Resolution                                    10 kHz

Amplitude Resolution                                    0.10 dB

T4600-DINT Option
   Frequency Range
      Band1                                    820-960 MHz
      Band2                                    1700-2000 MHz

   Integrated Phase Noise
   The measurement assumes a CW tone at -30 dBm.

   Phase noise specification in Band 1 is and integrated measurement from a 285
   kHz offset to a 1.515 MHz offset from the CW carrier frequency.

   Phase noise specification in Band 2 is and integrated measurement from a 635
   kHz offset to a 1.865 MHz offset from the CW carrier frequency.

   *Band 1 integrated Phase Noise*                < -105 dBm
   *Band 2 integrated Phase Noise*                < -105 dBm

T4600-DINTM
   Frequency Range
   Band1                                          865-898 MHz
   Band2                                          1928-1992 MHz

   Integrated Phase Noise
   The measurement assumes a CW tone at -30 dBm.

   Phase noise specification in Band 1 is and integrated measurement from a 285
   kHz offset to a 1.515 MHz offset from the CW carrier frequency.

   Phase noise specification in Band 2 is and integrated measurement from a 635
   kHz offset to a 1.865 MHz offset from the CW carrier frequency.

   Band 1 integrated Phase Noise                  < -112 dBm
   Band 2 integrated Phase Noise                  < -106 dBm

**Interference Generator Mode**

    Maximum Tone Power
        820 - 960 MHz                                  -17 dBm
        1700 – 2200 MHz                            -20 dBm

    Absolute Accuracy of Tone Power             +/- 1.0 dB

**Carrier-to-Interference Mode**

    C/I Power Ratio Range
        Minimum C/I power ratio                 -90 dB
        Maximum C/I power ratio                +60 dB

    The achievable C/I power ratio, is a function of the input power level of the
    carrier signal, the desired output power level of the carrier signal, and the
    maximum available tone power.

    C/I Ratio Resolution                          0.1 dB

    C/I Ratio Accuracy
        C/I Ratio $\geq$ -75 dB                    +/- 1.0 dB
        C/I Ratio < -75 dB                     +/- 1.5 dB

**External Interferer Inputs**

    Number of inputs                            2, both inputs are shared
                                                  between channels

    Connectors                                    SMA-type

    Frequency Range
        TAS 4600A                            820-960 MHz
                                            1.7-2.0 GHz

        TAS 4600AE                        820-960 MHz
                                              1700-2200 MHz

        TAS 4600AH                        1700-2500 MHz

    Bandwidth
        Filter Type 1:                       $\leq$ 140 MHz
        Filter Type 2:                       $\leq$ 300 MHz
        Filter Type 3:                       $\leq$ 500 MHz
        Filter Type 4:                       $\leq$ 300 MHz

    Amplitude Resolution                        0.10 dB

Technical Specifications subject to change without notice.

Nominal Input Level  0 dBm

*Maximum Safe Input Level*  +10 dBm

## 7.4. Power Measurement

| | |
|---|---|
| Measurement Type | RMS power |
| | |
| Frequency range | |
|     TAS 4600A | 820-960 MHz |
| | 1.7-2.0 GHz |
| | |
|     TAS 4600AE | 820-960 MHz |
| | 1700-2200 MHz |
| | |
|     TAS 4600AH | 1700-2500 MHz |
| | |
| Averaging | |
|     Range | 1 to 1024 |
|     Measurement span per average | 400 milliseconds |
| | |
| *Relative Measurement Accuracy* | +/- 0.1 dB |

## 7.5. Safety and Environmental

This product is designed for compliance to:    CE Mark

Power Requirements
    Voltage    85-265 VAC (auto-sensing)
    Frequency    47-440 Hz
    Power    125 Watts (maximum)
    Fuse Type    8A, 250V slow-blow fuse

Operating Environment
    Temperature    0 to 50° C (32 to 122° F)
    Humidity    10% to 90%, non-condensing

Dimensions and Weight
    Height    6.9 inches
    Width    17.7 inches
    Depth    19.9 inches
    Weight    40 pounds

Calibration Interval    1 year

Warm-up time    30 minutes

### Display & Indicators

Display type    Yellow backlit LCD,
4 rows x 40 columns

Status Indicators    Autoset and bypass LED's

### Interfaces

RS-232 (DCE)    9-pin female connector ,
supports data rates up to 4800 bps

IEEE-488    Implements IEEE-488.1 standard

Auxiliary Port    RJ-45 connector,
Provided for maintenance and
calibration only

### Program Storage

PCMCIA Card    2 Megabytes FLASH
Memory

Technical Specifications subject to change without notice.

# ⚠ 7.6. Fuse Replacement Procedure

The fuse is installed at the factory to match the most commonly used line voltage in the country of destination.

**Caution - Disconnect from the supply before servicing**

1.  Locate the power entry module on rear panel.

2.  Using a small screwdriver, pry out the fuse holder using the notch at the top of the power entry module. Refer to diagram below.
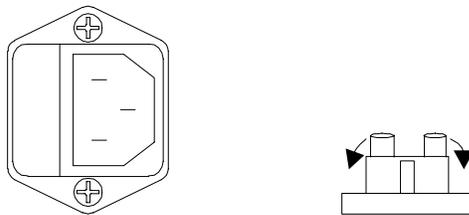


3.  Pull the fuse from the fuse holder as shown above.

4.  To reinstall, select the proper fuse and place in the fuse holder.

| TAS Part Number | Type |
|-----------------|------|
| 1800-3958 | 8A 250V Slow-Blow Fuse |

5.  Reinsert the fuse holder into the power entry module.

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## 8.0. APPENDIXES

### 8.1. Appendix 1: Standard Test and Factory Default Profiles

The following section lists the contents of the read-only standard test profile parameters that will be set when a recall is performed. The profile for the factory default is also included for reference purposes. Parameters that are not listed in the profiles will remain the same as before the recall operation. Files described in sections 8.1.2. through 8.1.7. are available on TAS 4600A and TAS 4600AE only.

### 8.1.1. TAS 4600A Factory Default Test Profile

| DEFAULT VALUES | | |
|---|---|---|
| **Configuration** | | |
| Carrier to Noise Units | C/N | |
| Noise Generator Units | dBm | |
| Interference Source A Status | off | |
| Interference Source B Status | off | |
| CW Source A Frequency (MHz) | 880.90 | |
| CW Source B Frequency (MHz) | 881.70 | |
| **Channel** | **1** | **2** |
| Carrier Freq. (MHz) | 880.0 (4600A & 4600AE) 1940 (4600AH) | 880.0 (4600A & 4600AE) 1940 (4600AH) |
| Emulation Mode | C/N | C/N |
| Receiver Bandwidth (MHz) | 1.23 | 1.23 |
| Carrier to Noise Ratio (dB) | -1.0 | -1.0 |
| Bit Rate (bps) | 9600 | 9600 |
| $E_b/N_0$ Ratio (dB) | 20.1 | 20.1 |
| $C/N_0$ (dB) | 59.9 | 59.9 |
| C/I (dB) | 0 | 0 |
| Noise Power Density (dBm) | -100.0 | -100.0 |
| Output Level (dBm) | -50.0 | -50.0 |
| Power Level Offset (dB) | 0 | 0 |
| **Measure** | | |
| Monitor Point | CH1 | |
| # Averages | $1\ (2^0)$ | |
| Duty Cycle | 100% | |

### 8.1.2. IS-97A Dual Mode Cellular Receiver Performance in AWGN Test Profile

This standard test profile for IS-97A was derived from the EIA/TIA/IS-97A July 1996.  See Section 8.1. for more information.  This file requires the extended output level option to be present.

| | IS-97A AWGN Test File | |
|---|---|---|
| **Configuration** | | |
| Carrier to Noise Units | Eb/N0 | |
| Noise Generator Units | dBm | |
| Interference Source A Stat | Off | |
| Interference Source B Stat | Off | |
| **Channel** | **1** | **2** |
| Emulation Mode | C/N | C/N |
| Carrier Freq. (MHz) | 835.0 | 835.0 |
| Output Power Level (dBm) | -76.0 | -76.0 |
| Noise Power Density (dBm/Hz) | -100.0 | -100.0 |
| Receiver Bandwidth (MHz) | 1.23 | 1.23 |
| Carrier to Noise Ratio (dB) | -11.1 | -11.1 |
| Bit Rate (bps) | 9600 | 9600 |
| $E_b/N_0$ Ratio (dB) | 10.0 | 10.0 |
| $C/N_0$ (dBHz) | 45.3 | 45.3 |
| C/I (dB) | 0 | 0 |
| **Measure** | | |
| Monitor Point | CH1 | |
| # Averages | 2 ($2^1$) | |
| Duty Cycle | 100% | |

### 8.1.3. IS-98A Dual Mode Cellular Receiver Performance in AWGN Test Profile

This standard test profile for IS-98A was derived from the EIA/TIA/IS-98A July 1996. See Section 8.1. for more information.

| | IS-98A AWGN Test File | |
|---|---|---|
| **Configuration** | | |
| Carrier to Noise Units | C/N | |
| Noise Generator Units | dBm | |
| Interference Source A Stat | Off | |
| Interference Source B Stat | Off | |
| **Channel** | **1** | **2** |
| Emulation Mode | C/N | C/N |
| Carrier Freq. (MHz) | 880.0 | 880.0 |
| Output Power Level (dBm) | -55.0 | -55.0 |
| Noise Power Density (dBm/Hz) | -100.0 | -100.0 |
| Receiver Bandwidth (MHz) | 1.23 | 1.23 |
| Carrier to Noise Ratio (dB) | -1.0 | -1.0 |
| Bit Rate (bps) | 9600 | 9600 |
| $E_b/N_0$ Ratio (dB) | 20.1 | 20.1 |
| $C/N_0$ (dBHz) | 59.9 | 59.9 |
| C/I (dB) | 0 | 0 |
| **Measure** | | |
| Monitor Point | CH1 | |
| # Averages | $2 (2^1)$ | |
| Duty Cycle | 100% | |

## 8.1.4. IS-97A Dual Mode Cellular Receiver Performance in Multipath Fading & AWGN Test Profile

This standard test profile for IS-97A was derived from the EIA/TIA/IS-97A July 1996. It is designed to be used in a test system that includes a TAS 4500 RF Channel Emulator.  The TAS 4500 RF Channel Emulator models the multipath fading required for CDMA testing.  See Section 8.1. for more information.  This file requires the extended output level option to be present in the 4600.

| | IS-97A Fade Test File | |
|---|---|---|
| **Configuration** | | |
| Carrier to Noise Units | Eb/N0 | |
| Noise Generator Units | dBm | |
| Interference Source A Stat | Off | |
| Interference Source B Stat | Off | |
| **Channel** | **1** | **2** |
| Emulation Mode | C/N | C/N |
| Carrier Freq. (MHz) | 835.0 | 835.0 |
| Output Power Level (dBm) | -93.5 | -93.5 |
| Noise Power Density (dBm/Hz) | -100.0 | -100.0 |
| Receiver Bandwidth (MHz) | 1.23 | 1.23 |
| Carrier to Noise Ratio (dB) | -9.4 | -9.4 |
| Bit Rate (bps) | 9600 | 9600 |
| $E_b/N_0$ Ratio (dB) | 11.7 | 11.7 |
| $C/N_0$ (dBHz) | 45.3 | 45.3 |
| C/I (dB) | 0 | 0 |
| **Measure** | | |
| Monitor Point | CH1 | |
| # Averages | $16 \ (2^4)$ | |
| Duty Cycle | 100% | |

### 8.1.5. IS-98A Dual Mode Cellular Receiver Performance in Multipath Fading & AWGN Test Profile

This standard test profile for IS-98A was derived from the EIA/TIA/IS-98A July 1996. It is designed to be used in a test system that includes a TAS 4500 RF Channel Emulator.  The TAS 4500 RF Channel Emulator models the multipath fading required for CDMA testing.  See Section 8.1. for more information.

| | IS-98A Fade Test File | |
|---|---|---|
| **Configuration** | | |
| Carrier to Noise Units | C/N | |
| Noise Generator Units | dBm | |
| Interference Source A Stat | Off | |
| Interference Source B Stat | Off | |
| **Channel** | **1** | **2** |
| Emulation Mode | C/N | C/N |
| Carrier Freq. (MHz) | 880.0 | 880.0 |
| Output Power Level (dBm) | -55.0 | -55.0 |
| Noise Power Density (dBm/Hz) | -100.0 | -100.0 |
| Receiver Bandwidth (MHz) | 1.23 | 1.23 |
| Carrier to Noise Ratio (dB) | 2.0 | 2.0 |
| Bit Rate (bps) | 9600 | 9600 |
| $E_b/N_0$ Ratio (dB) | 23.1 | 23.1 |
| $C/N_0$  (dBHz) | 62.9 | 62.9 |
| C/I (dB) | 0 | 0 |
| **Measure** | | |
| Monitor Point | CH1 | |
| # Averages | $16 \ (2^4)$ | |
| Duty Cycle | 100% | |

### 8.1.6. IS-97A Dual Mode Cellular Receiver Single Tone Desensitization Performance Test Profile

This standard test profile for IS-97A was derived from the EIA/TIA/IS-97A July 1996. It is designed to be used with an external CW source acting as an interferer. The external CW should be connected to the Ext A input on the rear panel of the 4600 at a nominal level of 0.0 dBm. The frequency should be 835.75 MHz or 834.25 MHz.  See Section 8.1. for more information.  This file requires the extended output level option to be present in the 4600.

| | IS-97A Desens(itization) Test File | |
|---|:---:|:---:|
| **Configuration** | | |
| Carrier to Noise Units | Eb/N0 | |
| Noise Generator Units | dBm | |
| Interference Source A Stat | Ext | |
| Interference Source B Stat | Off | |
| **Channel** | **1** | **2** |
| Emulation Mode | C/I | C/I |
| Carrier Freq. (MHz) | 835.0 | 835.0 |
| Output Power Level (dBm) | -102.0 | -102.0 |
| Noise Power Density (dBm/Hz) | -100.0 | -100.0 |
| Receiver Bandwidth (MHz) | 1.23 | 1.23 |
| Carrier to Noise Ratio (dB) | -15.6 | -15.6 |
| Bit Rate (bps) | 9600 | 9600 |
| $E_b/N_0$ Ratio (dB) | 5.5 | 5.5 |
| $C/N_0$ (dBHz) | 45.3 | 45.3 |
| C/I (dB) | -50.0 | -50.0 |
| **Measure** | | |
| Monitor Point | CH1 | |
| # Averages | $2 (2^1)$ | |
| Duty Cycle | 100% | |

### 8.1.7. IS-98A Dual Mode Cellular Receiver Single Tone Desensitization Performance Test Profile

This standard test profile for IS-98A was derived from the EIA/TIA/IS-98A July 1996. It is designed to be used with an external CW source acting as an interferer. The external CW should be connected to the Ext A input on the rear panel of the 4600 at a nominal level of 0.0 dBm. The frequency should be 880.90 MHz or 879.10 MHz. See Section 8.1. for more information. This file requires the extended output level option to be present in the 4600.

| | IS-98A Desens(itization) Test File | |
|---|---|---|
| **Configuration** | | |
| Carrier to Noise Units | C/N | |
| Noise Generator Units | dBm | |
| Interference Source A Stat | Ext | |
| Interference Source B Stat | Off | |
| **Channel** | **1** | **2** |
| Emulation Mode | C/I | C/I |
| Carrier Freq. (MHz) | 880.0 | 880.0 |
| Output Power Level (dBm) | -101.0 | -101.0 |
| Noise Power Density (dBm/Hz) | -100.0 | -100.0 |
| Receiver Bandwidth (MHz) | 1.23 | 1.23 |
| Carrier to Noise Ratio (dB) | -1.0 | -1.0 |
| Bit Rate (bps) | 9600 | 9600 |
| $E_b/N_0$ Ratio (dB) | 20.1 | 20.1 |
| $C/N_0$ (dBHz) | 59.9 | 59.9 |
| C/I (dB) | -71.0 | -71.0 |
| **Measure** | | |
| Monitor Point | CH1 | |
| # Averages | $2 (2^1)$ | |
| Duty Cycle | 100% | |

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