TA7100/TA7300 Vector Network Analyzers

User's Guide

Version 1.21



TA7100 (100kHz-1800MHz) TA7300 (300kHz-3200MHz)

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Safety Summary

Safety Level

This manual has the following conventions for presenting information.

WARNING: A warning alerts you to any condition that could cause personal injury.

CAUTION: A caution alerts you to any condition that could cause a mechanical failure or potential loss of data.

Make sure the AC power supply voltage meet the equipment requirements, otherwise it will cause a equipment failure.

Make sure to plug the power cable into an electrical outlet that has safety grounding before turning on the power switch.

Touching the internal circuit may cause a mechanical failure or personnel injury, so only trained engineer can remove the instrument cover and maintain the instrument.

Guarantee

This instrument is guaranteed for a period of 18 months from the date of shipment. Under warranty, any fault not caused by improper use will be repaired for free.

Liability of the user: Use this instrument according to this instruction manual. When this instrument needs to be repaired, please send it back to our company or our appointed repair center.

The guarantee is limited only to the instrument and does not involve any damage of equipment, personnel and property caused by improper use of the instrument.

Limitation of Guarantee

The warranty is not applicable for the faults resulted by improper use or inadequate maintenance (including software or interface), and unauthorized open of the instrument. Within the 18 months warranty period, calibration, maintenance service and consultation shall be free. After the 18 months warranty period, fees for material and repair workman will be charged appropriately.

The following items are not under warranty:

- A. Damage caused by improper voltage input.
- **B**. Deformation or damage of panel, switches, devices and case as well as defects involving interval parts caused by external mechanical force (shocking and dropping, etc.).
- **C**. Defects caused by unauthorized repair.
- D. Defects caused by the instrument worked beyond the required technology specification.

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1. General Information

This chapter is divided into the following sections:

- Brief Introduction
- Inspection
- Instruction of Standard Spare Parts and Order Information
- Brief Instruction of This Manual
- ESD(Electrostatic Discharge)
- Technical Support and Service Information

1.1. Brief Introduction

TA7100/TA7300 series Vector Network Analyzer which have high precision and large dynamic range is developed by Deviser Co., Ltd.

Features

- > 1k Hz frequency resolution.
- More than 70 dB of transmission dynamic range.
- > One-port calibration, reflection dynamic range > 50 dB.

Application area RF system (whatever radio stations, cable television, communication receive equipment or other radio applications).

It can be used for measurement and inspection on narrowband filter, SAW devices, amplifiers, splitter/combiner, attenuator, impedance transformation components, cable and etc.

It has several output file formats and storage memory that can print the measurement result or connect with PC and combine the automatic measurement system. And the measurement trace saved in equipment could be viewed and compared at any time.

As an ISO 9001:2008 certified company, TA7100/TA7300 is produced strictly according to the international quality management system standard.

1.2. Inspection

Before first use, please check as following steps: Take the instrument out of the case, and ensure that no damage occurred during shipment.

Check the case and package carefully. If the package is in good condition, keep it for later shipment.

1.2.1. Check the Accessories

Check the accessories refer to sheet 1-1.

1.2.2. Check if the AC power supply voltage mentioned on the rear panel meets the local

voltage.

WARNING: Make sure to plug the power cable into an electrical outlet that has safety grounding for personnel safety.

1.2.3. Connect the AC power wire to the instrument and power on (POWER)

The hardware and software of the equipment will start working after power on. The screen will appear the copyright and version information, and then enter measuring application menu.

1.3. Instruction of standard Spare Parts and Order Information

Item	information
AC power line	
User's Guide	English

Sheet 1-1 TA7100/TA7300A/B Standard Spare Parts

1.4. Brief instruction of This Manual

Please read the instruction carefully before operation. This manual will introduce how to use the instrument.

1.4.1. Brief Description of Features

Users could learn about the main functions, features and appearance of the instrument through this manual.

The manual explains common features, functions and also measurement interface which make the operators to get familiar with the instrument easily.

1.4.2. How to self-calibration

Instrument calibration is very important before using. This manual introduces how to do calibration operation.

1.4.3. Application Illustration

The manual illustrate the operation of functions in varies of application.

1.4.4. List Useful Auxiliary Functions and Programming Commands

Introduce the configuration, control, output and save functions, and instruct to programmer.

1.5. ESD(Electrostatic Discharge)

Electrostatic discharge can damage or destroy electronic components; therefore, all works on electronic assemblies should be performed at an antistatic workstation. The following suggestions may help to reduce ESD damage that may occur during testing and servicing operations.

- Before connecting any coaxial cable to the instrument, momentarily ground the center and outer conductors of the cable.
- Personnel should be grounded with a resistor-isolated wrist strap before touching the center pin of any connector and removing any assembly from the unit.
- Be sure that all instruments are properly earth-grounded to prevent a buildup of static charge.

1.6. Technical Support and Service Information

Users can contact Deviser or our local distributor for technical support and service.

Contact information:

Tianjin Deviser Electronics Instrument Co., Ltd.

Add: N0.8, Haitai Chuangxin 3rd Road, Hi-Tech Industrial Development Area, Tianjin, China, 300392

Tel: +86-22-2764 5003 ext. 803

Fax: +86-22-2764 5002

http://www.deviserinstruments.com

E-Mail: overseasbiz@deviser.com.cn

If you have special application, Deviser can also provide the technique support including software customization service.

2. Getting Started

- Front Panel Descriptions
- Rear Panel Descriptions
- Side Panel Descriptions
- Screen Area Descriptions
- Menu Maps and Function Descriptions

2.1. Front Panel Descriptions

2.1.1. Overview of Front Panel



Figure 2-1 Front Panel Description

(1) Power Button

Press the power button, the green LED turn on, and the VNA boot up.

(2) USB

USB device interface

(3) LCD

The size of LCD is 10.4 in. The display resolution is 800×600 .

(4) RF Output

This port outputs a continuous sweep signal or a fixed frequency RF signal. The maximum amplitude of output signal is +5dBm, this is a $50\Omega/75\Omega$ N-type, female connector. Also It is used as the signal input port when reflection measurements.

(5) RF Input

RF input port is used for the signal input port. This is a standard $50\Omega/75\Omega$ N-type, female connector.

CAUTION: Be sure that all the power and voltage of the input and output ports are in the safe range. The maximum input power of RF OUTPUT port is +20dBm and the maximum DC voltage is +25V; the maximum input power of RF INPUT is +20dBm and the maximum DC voltage is +25V.

2.1.2. Keyboard on the Front Panel

Front Panel buttons and functions



Figure 2-2 Front Panel Descriptions

(1) Entry Block





• 1 2 3..... Numeric and letter keys

The keys are used to enter the corresponding number and letter. In data entry mode, press the button to enter the order number.

G/n M/u k/m x1 Unit keys

Add a prefix to the numeric data typed with the numeric key, and then enter that data. One of the two prefixes written on the surface of the key is automatically selected depending on the parameter to be entered. X1 is entered without a prefix being given.

(2) Navigation block



Figure 2-4 Navigation Block

♠ ① ↓

These buttons is used to increase/decrease the value or move up/down through a list. Especially It can be used as fast step key with step 1, 2, 5.

The rotary wheel can change the values of needs of measurement frequency, reference level and the cursor position continuously according to the step. Continuous change depends on the range of the measurement. Rotary wheel rotation speed did not affect the rate of change of value of a quantity.

In addition to the manual input in the process of parameter modification wheel can also use the key Knob

Use 😰 🕓 keys can quickly change parameters avoiding troubles of inputting. It changes regularly by 1, 2 and 5 step

increasingly or decreasingly. It could be hold continuously to change parameters rapidly to the expected value. Parameters could be change with roller, and its changing rule is linear. It could reduce users' workload to use knob and rapid step key that makes the measurement more efficiently.

ESC ESC key

When typing with number keys, if it is wrong typing, press this button to make the cursor returned to the previous position and delete the digit.

When using number keys to input digits, point and symbols, if it is wrong typing, backspace key could be used to delete the wrong data, and new data could be typed in. Press [Unit] key to confirm after typing. If there is no [Unit] key, press [Enter] to confirm. (Caution: data would only be changed by the system after confirming.)

After completing inputting data, if it is wrong, it could be re-typed without pressing function buttons. If the inputted data is out of the range, the system would adjust it to maximum or minimum value automatically.

ENTER ENTER key

ENTER key is used for confirmation of data inputting. Press the ENTER to complete the data inputting.

(3) Stimulus



Figure 2-5 Source Setup

♦ START

This key is used to set the start frequency of signal output. If the input frequency is less than minimum start frequency, the start frequency will be default as minimum start frequency.

♦ STOP

This key is used to set the stop frequency of signal output. If the input frequency is larger than maximum stop frequency, the stop frequency will be default as maximum stop frequency.

CENTER

This key is used to set the central frequency of screen. If the input frequency is larger than maximum stop frequency, the central frequency will be default as maximum stop frequency with a span of 0. If the input frequency is less than minimum start frequency, the central frequency will be default as minimum start frequency with a span of 0.



The function of SPAN is setting the span of the network analyzer whose range is from 0 to 1.6714GHz. When the center frequency is set to the maximum or minimum value, sweep width is automatically set to 0 Hz. When the sweep width setting value is beyond the lower limit of frequency, the instrument will automatically enlarge the center frequency to 2 times of minimum frequency as the current sweep width instead of the entered sweep width values. Conversely, when the sweep width setting value is beyond the lower limit of frequency, the instrument will automatically enlarge the center frequency to 2 times of maximum frequency range to as the current sweep width instead of the entered sweep width values.

Formula:

Span = Stop frequency - Start frequency

```
Center frequency = (Start frequency+ Stop frequency) / 2
```

Caution: Any operation of adjustment of signal source frequency would make the original calibration data invalid after calibration, which needs to be calibrated again. When users do the approximate calibration, if the current frequency is within calibration frequency, or the point is not the same as calibration point, then the calibration value is the approximate value, otherwise it is invalid.

SWEEP STEUP

Pressing this key will activate the first level selective menu. Output power, sweep time, sweep points, channel coupling and etc. could be set with the function options.

TRIGGER

Pressing this key will activate the first level selective menu. Trigger type and trigger source could be set according to the menu.

(4) CH



Figure 2-6 CH

CHAN PREV CHAN NEXT Logical Channel Switch

When dual-channel is open and split screen display is on, two logical channel measurement curves are displayed separately in two windows. The logical channel switch key is used to activate the later or former channel.

TRACE PREV TRACE NEXT Curve Switch

In split screen display is off, the screen shows the measurement curve in one window. The curve switch key is used to activate the later or former measurement curve.

Each logical channel can display up to two curves: measurement curve and storage curve. Two display channels can display different measurement items of different measurement channels, and also different measurement items of the same measurement channel.

For example: CH1 display LOG_MAG of reflection measurement (A/R).

CH2 display LOG_MAG of transportation measurement (B/R).

Activate the tag						
DEVISE	R /			Main Measur	re	
	▶CH1+Cor	REFL (A/R)	LOG MAG	10 dB/	0 dB	
E0 00	CH2+Cor	TRAN (B/R)	LOG MAG	10 dB7	-30 dB	
00.00					1 \$21 625 MHz	0.002.48

Figure 2-7

(5) INSTR/STATE



Figure 2-8

♦ SYSTEM

Users can make system setup, such as system time, communication setup, system information and system self-checking etc.

◆ PRINT

Configure and set up the printer and print files.

♦ SAVE RECALL

This key is used for saving and recalling bmp file and state file.



Pressing this key will recover the factory configuration.

(6) Response



MEAS

This key is used for selecting the measurement method.

♦ FORMAT

This key is used for changing the data display format. The same test result would be given in different forms and units through conversing. Choosing reflection measurement format during transmission is invalid.

♦ SCALE

This key is used for changing the display of the scale and location on the screen to make the test curve display in an appropriate size on the screen.



This key is used for one/two display window switch and display color setup.



This key is used for making trace flat and stable, such as data average, date smooth and RBW



This key is used for calibration.

(7) MKR/Analysis



MARKER

This key is used to open/close 8 markers.

MARKER SEARCH

This key is used for marker searching, including maximum, minimum and marker tracking.

•	MARKER ECTN
•	MANKENTCHN

This key is used for active marker, statistic analysis and tilt analysis setup.



This key is used for functions including fault location, SRL (structure return loss), Conversion, limit test and filter analysis.

(8) Soft Key



Figure 2-11



Enter the main menu.



Eight soft keys activate the corresponding function displayed on the screen.



Return.

2.2. Rear Panel Descriptions

2.2.1. Rear Panel Interface



Figure 2-12 Rear Panel

(1) AC Power Input Socket

The socket is used for the power supply of instrument. The maximum current power through the socket is 300V, and the rate value of the power fuse is F4A / 250 V.

2.3. Side Panel Descriptions



Figure 2-13 Side Panel

(1) LAN

RJ-45 Ethernet port for PC connection

(2) Color VGA Output

This interface can connect with VGA display in any size. The display will display the same graphics as the screen of the device in order to observe the measurement results in detail rapidly.

An external monitor interface signals:



2.4. Screen Area Descriptions

This section describes the names and functions of parts on the LCD screen of the VNA. The VNA displays the test trace and information on the LCD.

2.4.1. Screen Area Description when DUAL = OFF

- Press DISPLAY button, enter DISPLAY menu
- Turn off dual mode shown as figure 2-13.



No.	Description	Menu
1	Symbol indicates the current channel is active channel and the information display on	CH PREV CH NEXT
	the screen is the attribute of active channel.	
\bigcirc	Show all the measurement channels information. It includes channel name and	
	calibration status.	
3	It indicates measurement method of every channel. It includes transmission and	MEAS
3	reflection method	
4	It indicates whether the active channel scale method is Log, Line or SWR method.	FORMAT
5	It displays the scale per division. User sets the scale/div to fit the screen.	SCALE
6	Display value of the reference line.	SCALE
7	Display the logo	
8	Soft-keys Menu block.	
9	Symbol specifies the reference position.	SCALE
10	It indicates the output power of the sweep source.	SWEEP SETUP
(11)	It indicates the frequency setting of sweep source. It includes start frequency, stop	START STOP
	frequency, center frequency and frequency span.	CENTER SPAN

Table 2-1 Screen Area Descriptions

2.4.2. Screen Area Description when DUAL = ON

- Press DISPLAY to enter DISPLAY menu.
- Turn on dual mode shown as figure 2-14



Figure 2-15 Dual Window Mode

In display of dual mode, the traces of two channels are shown in different windows.

2.5. Menu maps and function descriptions

2.5.1. Menu maps

> TRIGGER





SWEEP SETUP

This menu is for the stimulus setting. Set the test conditions for power, sweep time, points, and channel couple status.





(1) INSTR STATE Block

A group of keys related to the macro function, save/recall function, control/management function, and presetting the TA7100/TA7300 (returning it to the preset state)

PRINT Setting the printer and print file.



Figure 2-18 PRINT Menu

> SYSTEM setting the system



Figure 2-19 SYSTEM menu

SAVE /RECALL

It is for saving the trace to BMP file and reading the file from the disk, and saving the VNA setting condition to file and recalling the condition for file (state files).





(2) **RESPONSE Block**

A group of keys are used mainly for setting up response measurements on the TA7100/TA7300. It includes MEAS, FORMAT, SCALE, DISPLAY, AVG and CAL.

> MEAS

Setting the test channels Transmission=B/R, Reflection=A/R.



Figure 2-21 MEAS menu

> FORMAT

Setting the data format





> SCALE

Setting the display scale



Figure 2-23 SCALE menu

> DISPLAY



Figure 2-24 DISPLAY menu

> AVG



Figure 2-25 AVG menu

> CAL



Figure 2-26 CAL menu

(3) MKR/ANALYSIS Block

A group of keys which is used for analyzing the measurement results by using the markers and etc. For functions of the keys in the MKR/ANALYSIS block, see Chapter 2 "Overview of Functions" in the guide

> MARKER



Figure 2-27 MARKER menu

> MARKER SEARCH



Figure 2-28 MARKER SEARCH menu

> MARKER FCTN



Figure 2-29 MARKER FCTN menu

> ANALYS



Figure 2-30 ANALYS menu

Fault Location



Figure 2-31 Fault Location menu

LIMIT TEST



Figure 2-32 LIMIT TEST menu

FILTER ANALYSIS



Figure 2-33 FILTER ANALYSIS menu

2.5.2. Menu Functions Descriptions

2.5.2.1 System Menu

2.5.2.1.1 SYSTEM system setup key

For the operation of whole device using and controlling of many instruments, it could be done by pressing this button. It includes setup and operation of system configuration and service, for instance, instrument display language, clock setting, communication setting, product information and the system test operation, and etc.

The SYSTEM key is used for setting parameters shown as figure 2-33. It has 4 sub menus.



Figure 2-34 System Menu

SYS Setup)

System Setup

Press the [System Setup] soft-key, and then the two sub-menus will be active. The functions are shown:

Language 中文 ENGL Language setting \triangleright

Setting the menu to Chinese or English mode

 \triangleright

≻

Clock settings

Press the [Clock] soft-key to active the next level menu. You can set year/month/day/hour/minute.

Network

Clock

Network Settings

Press the [Network] soft-key access to the next level menu which can set up the IP address and Subnet mask of the network communication ports by numeric keys and decimal point key with the "ENTER" key to end.





Set the Beep CAUT ON or OFF. When it is ON, the user will be notified with a beeper alert when a measurement has completed or settings have been saved. The user can open or turn off this function in demand.

Press this key, and the system will test the beeper sound.

💷 Turn beeper alarm on or off.

Turn the Beeper alarm ON or OFF. When it is ON, the user will be notified with a beeper if the limit test is FAIL. The user could turn this function ON or OFF in demand.



Press this key and the system will test the beeper sound for alarms.

	Return	
* I		Return

Confirm

Press the "Return" key to access the previous menu.

 \triangleright

operate confirmation

Some important operations require the user to confirm avoiding incorrect operation. When the function is enabled, select the corresponding key and the next level confirm menu will pop up for the user to confirm. Skilled user can turn off this function in order to improve measurement speed.

Selecting the key will active the next menu which is consisted by five functions shown as below:

Factory Set ♦ ON OFF Resume Preset

It is set for that whether it needs the user to confirm or not when press the PRESET key.

Reset Color

It is set for that whether it needs user's confirmation when pressing the [Reset Color] key.



♦ IN IFF Delete Configuration file

It is set for that whether it needs user's confirmation when pressing the [Delete Configure] key.



It is set for that whether it needs user's confirmation when pressing the [Delete Picture] key.



Formatting user's storage space

Brightness

✤ 35 % Set Brightness function

Select this option and the backlight brightness setting could be done through the knob, up and down keys, and key figures.
> VGA Model Setting
VGA Model VGA Model State
Set VGA Mode on or off
♦ UGA Offset function
Select whether to open the VGA trimming function or not.
◆ UGA HFP 47 VGA HFP function
Set the VCLK number of the VGA between the end of a line of effective data and the next level synchronization signal began.
◆ UGA HBP 194 VGA HBP function
Set the VCLK number of the VGA between the beginning of level synchronization signal and a line of effective data began.
• System Test
Select the key to active the two level menus which are as follows:
> Display LCD Display test
Select this function, the VNA system will display on the LCD screen with different color of white, black, red, green and blue to
check the LCD quality.



Key-press test

Press the [Panel] soft-key access to "Key-press measurement" interface which provides the measurement functions of all keys and knob. Press the key-press on the front panel, if the corresponding key icon on the screen acts which shows that the key-press succeeds otherwise failed. Press the Return key two times to exit the menu.



Figure 2-35 Key-Press Test

Help Help

Select this function, and then the version information of the instrument will display. Meanwhile, the Quick Start button could be used to know the method of using the device.

sys update by Update the system software and firmware.

2.5.2.1.2 PRINT Print file or printer settings

Press the PRINT key and the sub menu will be active, shown as figure 2-38.

Users can set up printing operation or print item according to menu prompt. The menu has two functions which are as follows (reading refer to display menu of the analyzer or outspread menu behind):



Figure 2-36 Print Menu

Start
 Print file

Press the [Start] soft-key, and the content of the current screen will be exported to printer.

Remote Server IP Remote Server IP

Set the Remote Server IP. And print through the remote server printer.

2.5.2.1.3 SAVE/RECALL Save/Recall key

The analyzer has auto-save function. When rebooting the VNA, it will recall the state file to recover the test condition as last time.

The user can save and read the VNA state files manually. The state files consist of instrument state data, calibration data, and measurement of the trace data. The instrument state data is the user's settings information which contains frequency range, output power level, scan state, trigger mode, and etc. If the configuration files contain the instrument state data, and calibration data, recalling the file will load the user's settings and calibration data. It will save the operation time.

The analyzer supports the save, preview and import to U disk of the bitmap picture. It is convenient to save and process the picture files.

Press SAVE/RECALL soft-key and enter the sub-menu which consists of six functions, shown as figure 2-39.



Figure 2-37 Save Recall File Menu

Save
 State
 Save Configuration Files

Press the [Save State] soft-key to enter the sub-menu.

State01 *

More

state 01-07 is quick Save mode

The system provide 7 state save menus, corresponding "state01, 02, 03, 04, 05, 06, 07 state file name. The user press the [state01] icon to save the file with the same file name as the icon name

 \triangleright

≻

Save state file named by user.

Press the [More] soft-key access to save more file named by user. The file name consists of letter, number and blank. Use the entry block keys to input letter and number, and then press the ENTER key to finish the save file. If the file name input is in existence, the system will prompt whether overwrite the file or not.



≻

recall state File

Press the key to enter the sub menu which consists of seven functions



recall the configuration file from state01 \sim state07

The system provides seven groups one_ key quick recall file named state01, state02, state03, state04, state05, state06 and state07. The user could press the state file to recall the configuration file saved.



recall state from more files

Press the [More] key to active the next sub menu, and it comes into "configuration files management" interface where complete delete, recall, import and export of the file.

The menu has six functions which are as follows:

DEVISER		STATE FILE		
Name	Size	SaveTime	Select	Read State
Name 0001.STA 0002.STA 01.STA 02.STA 022701.STA 022701.STA 022702.STA 022703.STA 022703.STA 022711.STA 022711.STA 022713.STA 022713.STA 022713.STA 022713.STA 022713.STA	Size 2.32 KB 227.62 KB 2.32 KB 227.68 KB 227.68 KB 227.68 KB 277.68 KB 277.68 KB 227.68 KB 227.68 KB 2.32 KB 2.32 KB 2.32 KB 2.32 KB 2.32 KB	SaveTime 2014-02-2516:21 2014-02-2516:22 2014-02-2809:29 2014-02-2809:29 2014-02-2809:29 2014-02-2809:29 2014-02-2809:29 2014-02-2809:29 2014-02-2715:42 2014-02-2715:42 2014-02-2716:26 2014-02-2716:26 2014-02-2716:26 2014-02-2716:26 2014-02-2716:26 2014-02-2716:26 2014-02-2716:26 2014-02-2716:27 2014-02-2716:27 2014-02-2716:27 2014-02-2716:27 2014-02-2809:30 2014-02-2809:30 2014-02-2809:30 2014-02-2809:30 2014-02-2809:30 2014-02-2809:30 2000-01-0102:43	Select	Read State Select All Rename Delete Read File Trans> DIR >
				Return

Figure 2-38 Read the Configuration Files

```
Select
All
```

Select all state file.

The files need to be selected before they are deleted or moved to a USB disk. With the [Select ALL] key, the user can select all files quickly. Press the ENTER key to select a single file which is indicated with cursor.

Before rename the state file, please select the file which needs to be renamed.

✤ Delete Delete

Delete the selected files. If there is no selected file, the file which is indicated with cursor will be deleted.



Recall configuration file to set the test conditions with the selected state file.

♦ File Trans

♦

Trans the state files



Transmit the selected state files to U disk

Save the selected file to U disk which is insured to insert into the USB port of the instrument front panel. Do not pull out the U disk when the transmission is going on. Wait for the letter prompt on the status bar bottom of the menu and finish the operation.

Import From USB DISK

♦ USB DISK Import from U disk

Insert the U disk and press the key, system will check all files with type of ".STA" on the U disk, and import these files to the instrument disk, and display these files on the screen.



It includes New, Enter Sub and Return Main.



Setup the [save types] soft-key and decide the type of data contained in the file. The user can select the function correctly in demand.

Note: When recall the state files which contain trace data, the trigger source of the "SWEEP SETUP" menu switch automatically to manual mode and show the measurement curve of the file saved. If actual measurement is needed, please press the key to switch to internal mode.

Press the key access to the sub-menu which contains four functions.

State Only States only

It means the state file only save the test parameter settings.



After selecting the [States & Cal] soft-key, state files contain state data and calibration data.



States & Trace

After selecting the [States & Trace] soft-key, state files contain state data and trace data.



Save BMP

After selecting the [All] soft-key, state files contain state data, calibration data and trace data.



 \geq

Save Graphics File

All

Press the key, input the file name and save the current graphics file as "BMP" type. The file name contains only letters, numbers and blank. Input letter and number by number keys, press the ENTER key to finish saving. The default file name is "VNAPIC".

Read Graphics Files from internal disk

Press the key to enter the sub menu and come into "graphics files management" interface where to complete the operation of the delete, preview and transmission of the file. The menu has six functions following:

Name Size SaveTime Select Read fill 122701.6MP 937.55 KB 2014-02-27 15:35 0	DEVISER		IMAGE		뢂
D022011_ENR 937.55 KB 2014-02-27 15:35 0 0227011_ENP 937.55 KB 2014-02-27 15:45 0 0 022711_ENP 937.55 KB 2014-02-27 15:45 0 1 022711_ENP 937.55 KB 2014-02-27 15:45 0 1 1 0331_ENP 937.55 KB 2000-01-0102:43 0 0 1 0 VNILENP 937.55 KB 2000-01-0303:48 0	Name	Size	SaveTime	Select	Read BMP
	Name 022701.6MP 022701.6MP 022711.6MP 12.6MP 331.6MP VN1.6MP	Size 937,55 KB 937,55 KB 937,55 KB 937,55 KB 937,55 KB 937,55 KB	SaveTime 2014-02-27 15:35 2014-02-27 15:141 2014-02-27 16:28 2014-02-27 16:28 2014-02-25 16:21 2000-01-01 02:43 2000-01-03 03:48	Select	Read BMP Select All Rename Delete Preview
USB DI Retur					Trans To USB DISK Return

Figure 2-39 Read Graphics Files



Press the key to activate the next lower level menu. For printing function, it can save the color measuring interface. On the contrary, it is used for printing purposes. The screenshot function save graphics without the color options.

2.5.2.2 Signal Source Setup (STIMULUS)

2.5.2.2.1 TRIGGER key Trigger 🕨 Contin Trigger Mode settings Press the key to active the sub menu which sets trigger mode. The trigger mode has two functions which are as follows: Continuous ⊳ Continuous Trigger mode Press the key and the trigger mode will be changed to continuous trigger. In the continuous mode, the analyzer is triggered continuously; begin its next sweep at the conclusion of the current sweep. Single Single Trigger mode Press the key and the trigger mode will be changed to single trigger. Each trigger sent from the trigger source to that channel prompts a single sweep and then comes into waiting status. Hold ≻ Hold Trigger mode Press the key to stop the current data trace sweep immediately and hold the sweep until Single] or [Continuous] is selected. TRI Source▶ Internal Trigger Source Press the key to active the sub menu which sets the trigger with 2 sources. The functions are as follows: Internal Internal Trigger Selects the "internal" trigger source and the analyzer's trigger source is internal. The analyzer enters the normal measurement status. Manual ⊳ Manual

Selects the "internal" trigger source and the analyzer's trigger source is manual. The analyzer enters the display of measurement data status.

When recalling the trace data configuration file, the trigger source switches automatically to the manual mode and displays the saved measurement trace.

2.5.2.2.2 SWEEP SETUP key

Press the "sweep setup" key access to enter the sub menu named [SWEEP]. This menu is used for all of stimulus parameters setting, shown as figure 2-46.



Figure 2-40 Stimulus Menu

Normal Output Power setting

Power

Press the [Power] soft-key to enter sub menu. The functions are as follows:

Normal Output Power level

This function sets the output power level of the internal signal source of the analyzer. You can set it to Normal/ -5dBm/ -10dBm/ -15dBm/ -20dBm/ -25dBm/ -30dBm.

NOTE: In the measurement of the ratio, the change of output level of the signal source will change the measurement dynamic range. It needs recalibration after the signal source power output level changed.



Press the key can turn RF output on or off.

> Return Return

Sweep Time

Press the "Return" key access to enter the previous menu.

•

AUTO MANU Sweep Time settings

The function sets the sweep time. It is a switch item and the sweep time switch between the "automatic" and "manual". When automatic sweep time is enabled, the sweep time is kept to the time possible with the current measurement conditions. When manual sweep time is enabled, the sweep time can set by knob, quick step keys and the number keys. If the sweep time becomes lower than the analyzer's sweep time under the automatic sweep, the sweep time will be reset to the automatic sweep time.

The user can increase the number sweep points when observe the detail of the measurement. The increase of the number sweep points will delay the measure time and reduce the measure speed, so the user will select this mode in demand.

Points

Sweep Points settings

This option is used to set the sweep points. The minimum scanning points of TA7300 series is 101 points, and up to 1601 points

CH Coupled
 Channel coupled

Select the key to set whether couple between logical channel 1 and logical channel 2 or not; It is an on-off item. Pressing the key couple channel will switch between "ON" and "OFF". When "ON" is enabled, channel 1 and channel 2 is coupled, and sweep parameters of the two channel (for sweep frequency, sweep points, average times) is same. When "OFF" is enabled, the parameters of the two measurement channels can be set independently.

When the status is changed from OFF to ON, the sweep parameters of the current channel, such as sweep frequency, output power, sweep points and RBW, will cover up the other channel.

2.5.2.3 RESPONSE block descriptions

2.5.2.3.1 MEAS Measure frequency response key

Press the MEAS key, the sub menu would display on the menu area of the screen. User can set the measurement channel which displayed on the logical channel basing the function selection. The key have six functions which are as following, shown as figure 2-48.



Figure 2-41 Measurement Method Settings

Transmission Measurement method

Select the key and set the current logical channel to transmission measurement channel (B/R, B is the transmitted receiver signal, R is the reference receiver signal), "TRAN (B/R) " displayed on the upper part of the screen. Showed as figure 2-48.

Reflection

Reflection Measurement method

Select the key and set the current logical channel to reflection measurement channel(A/R, A is the reflect receiver signal, R is the reference receiver signal), "REFL (A/R) " displayed on the upper part of the screen showed as figure 2-48.



2.5.2.3.2 FORMAT data format key

Press the key to enter sub menu, shown as figure 2-49. It is used for setting the data format of current logic channel. The key has eight functions which are as follows:



Figure 2-42 Measurement Data Format Settings

LOG MAG LOg Magnitude

Set the data format of current logic channel to log magnitude format.



Set the data format of current logic channel to phase format. The measurement range is from $-180^{\circ} \sim +180^{\circ}$.

Delay Group Delay format

. ,

Set the data format of current logic channel to group delay format.

• SWR SWR format

Smith

Set the data format of current logic channel to SWR format.

SWR = (1 + P) / (1 - P)

P: Reflection coefficient

•

Smith chart format

Set the data format of current logic channel to smith chart format.

The Smith chart is a tool used to translate map the complex reflection coefficient to the DUT's impedance. In a Smith chart, the complex impedance plane is reshaped to form a circular grid, from which the series resistance and reactance can be read (R + jX).



Figure 2-43 Smith Chart

The horizontal axis (the solid line) is the real portion of the impedance—the resistance. The center of the horizontal axis always represents the system impedance (50 in this example).

The dashed circles that intersect the horizontal axis represent constant resistance. The dashed arcs that are tangent to the horizontal axis represent the constant reactance.

The upper half of the Smith chart is the area where the reactive component is positive and therefore inductive. The lower half is the area where the reactive component is negative and therefore capacitive.



IMPE MAG

Polar

Impedance format

Set the data format of current logic channel to Impedance format.

•

Polar format

Set the data format of current logic channel to polar format.

Each point on the polar format corresponds to a particular value of both magnitude and phase. Quantities are read vectorially: the magnitude at any point is determined by its displacement from the center (which has zero value), and the phase by the angle counterclockwise from the positive x-axis. Magnitude is scaled in a linear fashion, with the value of the outer circle usually set to a ratio value of 1. Since there is no frequency axis, frequency information is read from the markers.



Figure 2-44 Polar Chart

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Press this soft-key to access the next menu.

LIN MAG Linear format

Set the data format of current logic channel to linear magnitude format.

Select the linear magnitude format. Displays a transmission trace in terms of transmission coefficient, displays a reflection trace in terms of reflection coefficient.

Real Real format

Set the data format of current logic channel to real part format.

Display only the real (resistive) portion of the measured data on a Cartesian format. This is similar to the linear magnitude format, but it can show both positive and negative values.

Imaginary format

Set the data format of current logic channel to imaginary part format.

Display only the imaginary (reactive) portion of the measured data on a Cartesian format. This format is similar to the real format except that reactance data is displayed on the trace instead of impedance data.

Pre Page 2/2

² Pre Page

Press this soft-key to return previous menu.

2.5.2.3.3 SCALE Key

Press this key to access the scale menu. Allow changing of scale per division, reference level, and reference position for optimum viewing of measurements, shown as figure 2-52





Auto Scale Auto Scale

The auto scale function is used to tailor each scale (scale/DIV and the reference line value) automatically in such a way that traces will appear in the proper sizes on the screen for easy observation.



REF Value

REF Posion

Define the number of increments per division on the Y-axis. After selecting this option, you can through the digital input, quick step, quick wheel to change per division on the Y-axis in display area, and the top of the screen in item 4 is the display value scale of "Scale/DIV".



Reference Level

After selecting this option, you can change the value which is represented by the reference line (which is the reference line used for measuring the curve. It has an arrow " \rightarrow " in the end to indicate its position) through the digital input, quick step and quick wheel. The fifth option at the top of the screen is the displayed value of "REF Value".



Reference Position

Define the position of the reference line. The position must be specified using the number assigned to each division on the Y-axis starting at 0 (the least significant) running up to the number of divisions being used (the most significant).



Figure 2-46 Manual Scale Setup on a Rectangular Display Format



Figure 2-47 Manual Scale Setup on the Smith Chart Format



Figure 2-48 Manual Scale Setup on the Polar Format



Define the number of divisions on the Y-axis. An even number from 4 to 20 must be used. Once it is set, it is commonly applied to all traces displayed in any rectangular format within that channel.



Marker → Reference

Set the value of the reference line to the response value of the active marker on the active trace.

2.5.2.3.4 DISPLAY Key

Press this key to access the display menu. Display the menu with selections concerning type of data to be displayed, split or full screen, title and color.

DIIAI DUAL channel ON OFF

Toggle the display mode between single channel and dual channels. When the dual channel display open, data display area of the screen will also show the test curves of logical channel 1 and logical channel 2. And when the dual channel display closes, data display area of the screen will only display the test curve of the current channel.



Figure 2-49 DUAL ON



DUAL

ON OFF

Split CH

ON OFF

Display

Data ¢ Nem

Data Math)

Menu Hold)

Disp Style)

Next Page 1/2

A1

Split CH ON OFF Split channel

This key is used to set whether to display the measurement line of single logical channel or dual logical channel. It is a ON/OFF switch, which switch between on and off every time when it is selected. When the dual channel display is on, the data display area of the screen would display the measurement curves of channel 1 and channel 2 simultaneously. When it is off, it only display the current measurement curve.



Figure 2-51 Split Display

•	Display Display trace
Lesselect tl	he type of data to display on the screen.
≻	Data
Disp	lay only the data trace on the screen.
\triangleright	Mem
Disp	lay only the memory trace stored by the operation Data $ ightarrow$ Mem on the screen.
2	Data & Mem
Disp	lay the data trace and memory trace on the screen. You can now easily compare the data trace and memory trace on the
scre	en.
≻	OFF
Do r	not display the trace.
	Potue
۶	Return
Retu	urns to the soft-key display screen one level higher.
•	Data \Rightarrow Mem Data \rightarrow Mem
Press Da	ata \rightarrow Mem to store the measured trace data in memory
	Data Math⊳
	OFF Data Math
Select tl	he data math operation to perform.
	DEF
۶	OFF
Turr	n off data math functions (Do not perform data math).
	Data / Men
>	Data / Mem
DIVIO	de the measured data by the memory trace and store the result in the data trace.
<u>,</u>	Data * Hen
≻ Mul	Data * Mem tinly the data trace by the memory trace and store the result in the data trace
iviai	
	Data - Men
Subt	tract the memory trace from the data trace and store the result in the data trace.
\triangleright	Data + Men Data + Mem
Add	the data trace and memory trace and store the result in the data trace.
\triangleright	Return

Return to the soft-key display screen one level higher.

•	Menu	Hold⊫
	Alw	ays

Menu Hold Time

Select the time of Menu Hold. You can choose from 3 Second, 5 Second, 10 Second, 30 Second and Always.

Disp Style⊧ Salubrious Display Style

Select the display style to use.



Three style: Modern, Salubrious, Classic.

Next Page

Next Page 1/2

Press this soft-key to access the sub menu. It has five functions.

Grid ON OFF Grid \triangleright

Toggle the display graticule (grid) on and off.

Prompt ON OFF Prompt ⊳

Toggle the display graticule (grid) prompt on and off.

Title Label Title Label

2

Display the input for editing title labels. Each channel is allowed to have a title label up to 8 characters in length.



You can set the display color of the following items.

Measure Background

Data/memory trace

Text and lines of graphs

Limit lines

You set the color of each item by specifying the amounts of red (R), green (G), and blue (B) contained in the color. You can specify R, and B in 32 steps (0 to 31), G in 64 steps (0 to 63).

Press ENTER or (kinet and a switch R, G, B. Turn the knob to adjust the color.

Press "Reset Color" soft-key to reset the colors for all items to the factory default.



Invert the display colors for all channel windows. Inverting colors from the normal display will create white backgrounds.

Pre Page 2/2 Pre Page

Press this soft-key to return the previous page.

2.5.2.3.5 AVG Key

Press this key to access the average menu. Display the menu that allows selection of averaging parameters as well as system bandwidth and delay aperture selections.



Enables or disables averaging execution.



Set the averaging factor. The averaging factor must be defined as an integer from 1 to 999.

In averaging mode, the analyzer measures each frequency point once per sweep and averages the current and previous trace up to the averaging factor specified by the user. The instrument computes each data point based on an exponential average of consecutive sweeps weighted by the user-specified averaging factor.

As the averaging factor is increasing:

• Signal-to-noise ratio increases,

• Time for each individual sweep remains the same, but total measurement time increases. Averaging is better than system bandwidth reduction at minimizing very low frequency noise.



Clear the running average and restart it with the next sweep.

Smoothing
 Smoothing
 Smoothing

Enable or disable the smoothing function.

Smoothing can be used to reduce noise having relatively small peaks. By turning on smoothing, the value of each point on a trace is represented by the moving average over the values of several nearby points. The smoothing aperture (percentage of sweep span) defines the range of points to be included in the calculation of the moving average.

SM Aperture Smoothing Aperture

Set the smoothing aperture. After pressing this key, you can set smoothing aperture via digital input, quick step, and quick wheel. Data smoothing is to the average number of adjacent data points in order to smooth, as suggested by the trajectory. The average number of adjacent data points together, also called smoothing coefficient. Coefficient can be assigned a number of points or the percentage of X-axis span.

Note: please carefully choose smoothing coefficient, and smoothing coefficient will lead to show curve distortion.



Set the bandwidth of the IF filters from 1kHz to 50kHz in the receiver section of the network analyzer.

Narrowing the receiver IF bandwidth enables to reduce the effect of random noise on measurements. Narrowing the IF bandwidth to 1/10 the original bandwidth causes the receiver noise floor to decrease by 10 dB. But as the bandwidth increases, the sweep

speed gets faster and the trace noise increases.

2.5.2.3.6 CAL Key

Press this key to access the cal menu. Display the calibration menu options for the current measurement mode.

•	Normalize
•	(THRU)

Normalize Cal Execute a THRU calibration on RF OUT and RF IN.

Make a THRU connection between the test ports (between the connectors to which the DUT will be connected), Press "Normalize" to terminate the calibration.

Reflection▶

Reflection Cal

Display soft-keys for executing reflection calibrations.



Execute an OPEN calibration on the RF OUT.

	Short
\geq	

Short Execute an SHORT calibration on the RF OUT.



Load Execute an LOAD calibration on the RF OUT.



Terminate a calibration process and calculate the calibration coefficients.



Select the Calibration Type as STAN or APPR. This VNA support two calibration methods: standard calibration and approximate calibration. Standard calibration obtains a precise measurement results. The time needed for calibration process is very short, but it needs to be re-calibrated when measuring the frequency or scanning points. Approximate calibration needs longer time, but the calibration data is still valid when the changes of measuring frequency is within the calibration frequency, and the scanning points change.





Correct

Execute clearing the all calibration data.

Set the system impedance, 1Ω \sim 1000 Ω .



Speed factor is the ration of the signal transmitting speed in the coaxial cable and the signal transmitting speed in the free space. The speed factor of the ordinary cable factor is about 0.66. The speed depends on the dielectric constant (ϵ r) of the cable dielectric substance.

Velocity factor =
$$\frac{1}{\sqrt{\varepsilon_r}}$$

2.5.2.4 MKR/ANALYSIS

2.5.2.4.1 MARKER Key

Press this key to access the marker menu. Display the menu to set markers.



Pressing any one of these soft-keys makes the marker the active marker, (if previously off) turns it on and displays an input for setting the stimulus value.

The "*" after the marker number means that the marker is active.

More
 Markers
 More Markers

Display soft-keys for setting markers 5 to 8.



Turn off all of the markers.

MKR Table
 ON OFF
 Marker Table

Turn on or off the Marker Table.

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Press this key to enter sub-menu, and it has four functions:



Toggle to ON if you want to make the active marker the delta marker or reference point.

In delta marker mode, a reference marker is placed at the active marker position. All marker values are then displayed in reference to this delta marker.







ON OFF Marker Coupling function

Marker Couple is on. (Coupling ON)

The setting up and moving of markers is performed in coupled operation on the traces in both channels.

Marker Couple is off. (Coupling OFF)

The setting up and moving of markers is performed independently for each trace.



Figure 2-53 Turning Marker Coupling On or Off

FREQ Digits
FREQ Digits

Press this key to set the display frequency of digits (the sum of digits for an integer and decimal places)



Press this key to set the display amplitude of digits (the sum of digits for an integer and decimal places).



Press this key to return to the previous menu.

2.5.2.4.2 MARKER SEARCH Display soft-keys for performing searches using markers.

Display the "Marker Search Menu" on the right side of the screen. Manipulating the "Marker Search Menu" enables to move a marker to a specific point (maximum, minimum, and a point with a target value) on a trace.

Shown as figure 2-61



Figure 2-54 Marker Search function

• MAX * Searching

Searching maximum value function

Press the key to move the active marker to the maximum value on the trace.

MIN

Searching minimum value function

Press the key to move the active marker to the minimum value on the trace.

Tracking ON OFF

ON OFF Marker-tracking function

When tracking is on (Tracking ON), it allows you to track either the maximum value or the minimum value on a measurement trace after you press the "Search Maximum" or "Search Minimum" key. The marker-tracking function enables continuous update of marker search values on each sweep.

2.5.2.4.3 MARKER FCTN Markers Function

Invoke the menu to display the "Marker FCTN Menu" on the right side of the screen. There are five functions including:



Marker->Center function

Set the center frequency to the stimulus value of the active marker on the active trace and limit the span if necessary.



Figure 2-55 Marker Center function



Set the span frequency to the stimulus value of the active marker on the active trace.



Set the starting frequency to the stimulus value of the active marker on the active trace.

```
    Marker 
    Stop
    Marker->Stop function
```

Set the ending frequency to the stimulus value of the active marker on the active trace.



Figure 2-56 Marker Start Marker Stop

Marker 4 REF

Marker->Reference function

Set the value of the reference line to the response value of the active marker on the active trace. A soft-key with the same function is also provided in "Scale Menu".

Statistics⊧ •

Statistics function

Enable or disable the display of statistics. When it is enabled, the following three statistical data items (Mean value, Standard deviation and Peak-to-peak) will be displayed on the screen.



Figure 2-57 Calculate statistical data items

	Items	Statement
MEAN	[mean]	$\frac{\sum_{i=1}^{n} Xi}{n}$ (n: points; Xi: No. i response value)
S.DEV	[Standard deviation]	$\sqrt{\frac{\sum_{i=1}^{n} (Xi - mean)^{2}}{n - 1}}$ (n: points; Xi: No. i response value)
P-P	[Peak-to-Peak]	Max-Min (Max: Maximum response value; Min: Minimum response value)

Table 2-2 Statement of the meaning of MEAN, S.DEV and P-P

Flatness function

Flatness |

Enable or disable the display of flatness. When it is enabled, the span, gain, slope, and flatness between marker 1 and 2 will be displayed on the screen.

2.5.2.4.4 ANALYS Key functions descriptions

After pressing the ANALYS button on the screen menu area, there would be a select menu. Select one of the options analysis of the measurement operation. It has six options, described below:



Figure 2-58 Analysis menu



 \triangleright

fault location analysis functions key

Press this soft-key to active sub menu.

Fault Loct ON OFF Fault location function.

Turn on or off the Fault Loct



Set sweep range.

Press this soft-key to active the sub menu. You can set start $\$ stop $\$ center and span.

Tranf Type BandPass

set data transfer type

BandPass sets the conversion type to "band pass."

LP Imp. Set the conversion type to "low pass impulse."

Although two transformation types, band pass and low pass impulse, simulate the response of the impulse signal, the impulse width in the low pass impulse mode is half the width in the band pass mode. Therefore, the resolution is better in the low pass mode. If the DUT can be measured in the low pass mode, response data with better resolution is obtained in the low pass mode.



Window

set data transfer window

By using the window function, you can lower the level of side lobes. However, the width of the impulse and the rise time of the step become larger as a penalty. You can select from 4 types of windows: rectangle, maximum, normal and minimum. Rectangle has the narrowest width of impulse; maximum has the widest width of impulse.

Maximum sets the window type to maximum. Normal sets the window type to normal. Minimum sets the window type to minimum. b of the Kaiser Bessel function is set to 0. Kaiser Beta sets the window by specifying the b value of the Kaiser Bessel

function. The Kaiser Bessel function is a function to determine the shape of the window. The allowable setting range is 0 to 13.



Press Reflection Type to select the type of the values on the horizontal axis in reflection measurement from one-way or round-trip. See figure below

One Way	Sets the values displayed on the horizontal axis to one-way.
Round Trip	Sets the values displayed on the horizontal axis to round-trip.

Unit Seconds Set Unit

≻

Three units can be chose; they are Seconds, Meters, Feet.



The SRL feature is designed to measure cable impedance and structural return loss. Cable impedance is the ratio of voltage to current of a signal traveling in one direction down the cable. Structural return loss is the ratio of incident signal to reflected signal in a cable, referenced to the cable's impedance. Press SRL menu, it will show the SRL operation sub menu.

- SRL ON OFF Turn the SRL analysis function on or off Cutoff FREQ ⊳
 - 210.00 MHz Cut-off frequency options

To set the cut off frequency for SRL analysis function.

Conversion▶

data conversion options

Press [Conversion] menu, it will show the conversion operation sub menu



Press Limit Test menu, it will show the limit line measurement operation sub menu.



When turning on this option, if the limit test fails, VNA displays FAIL on the screen.



≻

≻

Set Single Limit type

Press the key to activate the next menu, enter the type menu of limit, and then you can set the type of single limit. The single limit of frequency range is the current start frequency to the end of frequency. You can select the MAX, MIN or OFF.



Edit limit line functions

Press [Edit Limit] menu and it will show the limit line measurement operation sub menu and enter the limit line edition interface. Shown as figure below

To use the limit test, you must first define the limit line. You can define a limit table for each trace, and you can define up to 12 limit lines (segments) in a limit table.



Figure 2-59 Limit Edit

At the same time, the Edit Limit Line menu used to create/edit the limit table is displayed. The following lists the functions that correspond to the soft-keys shown.



Delete the segment containing the selected cell from the limit table.

🛠 Add

Add a segment before the segment containing the selected cell to the limit table.

Press Add to add a segment to the limit table, and then specify the segment parameter values shown below.

Segment Parameter	Description	
Туре	Select the type of segment from the following:	
	OFF: Segment not used for the limit test.	
	MIN: The segment at which the minimum is specified.	
	MAX: The segment at which the maximum is specified.	
Begin Frequency	Specify the starting point for the Frequency value on the limit line.	
End Frequency Specify the ending point for the Frequency value on the limit		
Begin Amplitude	Specify the starting point for the Amplitude value on the limit line.	
End Amplitude	Specify the ending point for the Amplitude value on the limit line.	



Filter Analysis

Filter analysis functions

Press Filter Analysis, it will show the filter analysis measurement operation sub menu and enter the filter analysis interface. The filter analysis has 5 functions, described as below. And filter analysis can analyze the type of filter automatically. The VNA supports band-pass and band-stop filter analysis.



Figure 2-60 Band-Pass Filter

User Define
 User define function

If turn user define on, the X1dB center frequency of filter = center frequency of VNA. If turn user define off, the X1dB center frequency of filter is calculated by the VNA automatically. Figures as below show the difference between on and off.



Figure 2-61 Filter Analysis When User Define = Off



Figure 2-62 Filter Analysis When User Define = On



≻

Set frequency for attenuation analysis of filter

Press frequency setting and it will show the sub menu.

Figure as below shows how to measure the attenuation versus the frequency defined by [frequency setting]



Figure 2-63

LATT is the Max Value versus the frequency between L1 start and L1 stop RATT is the Max Value versus the frequency between L2 start and L2 stop P1 = marker2

P2 = r	narker5
--------	---------

Note:

Attenuation of Left band side(LATT)

Attenuation of Right band side(RATT)

Attenuation of frequency Point 1 of user define (P1)

Attenuation of frequency Point 2 of user define (P2)

XdB Value Setting

≻

X dB pass-band configuration

The function is used for setting XdB bandwidth measurement option. You can set XdB option, and VNA will measure the bandwidth of the filter according to the XdB setting. Showed as figure as below.

BW1BW2BW3, BW4 on the screen is the -1.5dB, -3dB, -6dB, -40dB bandwidth result. You can set the XdB as your application.

In terms of the XdB measurement result, the VNA calculates some factors of filter as below:

Q factor(Q) Insert Loss(I.L) Center Frequency(C.F) Cutoff Frequency of Left band side(L.F) Cutoff Frequency of Right band side (R.F) Shape Factor(S.F) Ripple of filter(RPL) ATTenuation of Left band side(LATT) ATTenuation of Right band side(RATT) attenuation of frequency Point 1 of user define(P1)

attenuation of frequency Point 2 of user define(P2)

Shown as figure as below



Figure 2-64 Filter Factor Analysis

SF = BW4/BW1

Q = C.F/BW1

Limit Test
 limit test for filter analysis functions
 The function has five sub-functions.



2.5.2.5 Soft-key

2.5.2.5.1 HOME key

Press this soft-key, eight functions can be choose.



3. Making basic Measurements

This chapter describes an overview of basic Measurements

- Introduction of the analyzer
- Introduction of limit line Measurements
- Introduction of the vector Measurement
- Examples of Measurements
- Optimizing Measurements
- Calibration

3.1. Introducing the Analyzer

3.1.1. Brief introduction

TA7100/TA7300 (300kHz~3200MHz) is a popular type vector network analyzer developed by Deviser. It is suitable for electronics device measurements. The VNA is with high performance such as fast sweep speed, high dynamic range, high accuracy, and etc. It also has friendly GUI, easy to use and quick measurements.

3.1.2. System Block Diagram



Figure 3-1 System Block Diagram

(1) SOURCE,ALC

RF signal source is a sweep signal whose frequency range is from 300kHz to 3200MHz. RF signal source can be used as a sweep signal or a CW signal, When SPAN =0, it becomes a CW signal, and can make a power sweep measurement.

(2) Receivers

CH R/A/B is 3 narrow band and high dynamic range receiver. It receives the signal frequency (from 300kHz to 3200MHz) which pass through the DUT to IF. The IF signal was digitized by high-speed ADC. DSP processes the data and sends it to MPU. MPU display the result on LCD.

3.1.3. Data flow



Figure 3-2 Data Flow
3.2. Limit test

The limit test feature allows you to set the limit line for each trace and then perform the pass/fail judgment for the measurement result.

The limit test is a function to perform the pass/fail judgment based on the limit line you set with the limit table. In the limit test, if the upper limit or lower limit indicated by the limit line is not exceeded, the judgment result passes; if it exceeds, the judgment result fails for all measurement points on the trace. Measurement points in the stimulus range with no limit line are judged as pass.

TA7100/TA7300 can define 20 limit lines for upper limit or lower limit

3.2.1. Limit Test procedure

Limit test is useful tools for product line. The operators only check the pass or fail other than reading the detail of the trace. The following examples explain how to use the limit test via a transmission measurement of the 836MHz filter. To follow along with these examples, connect your filter to the analyzer.

- Step1、Press
 CHAN PREV
 CHAN NEXT
 , select channel 2 (you can select any channel) , press
 MEAS
 , and press

 [Transmission]. Channel 2 is transmission method now.
- Step2、Press CENTER , press 8 , 3 , 6 , and press M/u . Center frequency is 836MHz.
- *Step3*、Press SPAN , press 2 , 0 , 0 , and press M/u . Frequency span is 200MHz.
- Step4、 Use two N-N cable connect the fixture to input and output port of the analyzer. Connect a through standard between the input and output of the fixture. Press CAL , press [Normalize], and after a beep from TA, the Calibrations is finished.
- Step5、Press ANALYS , press [Limit Test], and then press[Edit Limit], press [Add] to add a limit line. press ENTER to edit limit line. Use knob to change the type to "MAX". Press ENTER to switch to "Begin stimulus", press ENTER to edit "Begin stimulus", entry 7 , 9 , 6 , and press M/u to finish the frequency maximum limit set. Then edit the "End stimulus", "Begin response", "End response". The limit line is shown as figure 3-3





- Step6 You can create 20 segments of limit line on the screen. Figure 3-3 shows 6 segments. Press [Return] to finished the edition.
- Step7、 After all limit lines are completed, press [Return] to return menu. Then Press [limit Test ON/OFF], turn on the limit test. Press [Limit Line ON/OFF] to turn on limit line to show the limit line on the screen. Press [Fail Sign ON/OFF] and turn it on. And then limit line you set will be active.





Figure 3-4 Limit Test with Pass/Fail Warning

3.2.2. Beep warning when the judgment result is fail

Beep warning is an additional method of limit test which based on judgment of the test result. After limit test is active, and if the result is out of the limit range, the screen will display "FAIL". If beeper warning function is active, you can hear the beep "di...,di...,di...,di..., from VNA. If you turn the function off, Beep will disable immediately.

How to turn on the beeper? Press SYSTEM, [SYS setup], [Beeper], and then switch the [beep alarm] to "on". It means turning on the beep alarm for the limit test.

3.3. Measuring Devices with Your Network Analyzer

TA7100/TA7300 is a vector network analyzer. It is quite different from scalar network analyzer. This section provides a basic overview of how the network analyzer measures device.

Usually, a device has two types of parameter, transmission and reflection

Reflection parameter includes VSWR, return loss, impedance, and etc.

Transmission parameter includes gain, attenuation, phase shift, group delay, and etc.

3.3.1. Measuring amplitude response

Three receivers comprise the device of measuring amplitude and phase. One is reference receiver (CH R), and others are measuring receiver for transmission (CH B) or reflection (CH A). The CH R receives the stimulus signal from the internal source. The CH B receives the signal through the DUT. The CH A receives the signal reflected from the input port of DUT. The signal input two receivers is the reference signal(R) and the signal from DUT (B or A). The receivers measuring amplitude and phase are used to measure the ratio of signals. The scheme is Figure 3-5.

The reference signal and the signal from DUT are higher frequency RF signals, mix with LO (local oscillator) signal, and translate the RF to IF(intermediate frequency)which frequency is lower. After filter, power detection, amplifying and mathematical, the ratio of two signals will display on the screen.



Figure 3-5 Measure Amplitude Response

3.3.2. Measuring phase response

The scheme of measuring phase is Figure 3-6. The differences between measuring phase and amplitude are that after filtering the IF signal direct into the phase detector, and mathematical operation, the ratio of two signals will display on the screen .The range of phase is ±180°.







Figure 3-7 Measure Phase

3.3.3. Measuring Group Delay

Group delay is:

- A measurement of device phase distortion.
- The transit time of a signal through a device, versus frequency.
- The derivative of the device's phase characteristic with respect to frequency

Group Delay = tg =	-dφ 	φin ωin	Radians Radians/Sec
=	-1	dΘ	Θ in Degrees
	360°	df	fin Hz (ω = 2 π f)

 $d\phi$ is the phase difference between two adjacent frequencies df. The quantity df is commonly referred to as the aperture. The minimum

Aperture is equal to the analyzer's frequency span divided by the number of points minus one, and can be entered as a frequency or a percent of span. To measure group delay correctly, the phase difference at an aperture must be less than 180 degrees, satisfying the following relationship





Figure 3-8 Group delay approximate tilt of Phase-frequency response



Figure 3-9 measure group delay of 836 MHz filter

3.3.4. Measuring Impedance using the Smith Chart

The Smith chart format is used to display impedances based on reflection measurement data on the DUT. In this format, traces are plotted on the same spots as in the polar format. The Smith chart format display the marker response values: Resistance (Ω), reactance (Ω), and inductance (H) or capacitance (F)



Figure 3-10 Smith Chart Format

3.4. Measurement examples

TA7100/TA7300 series vector network analyzers are suitable for measuring crystal filter, SAW filter, ceramic filter, amplifier, splitter and distributor in product line. As mentioned above, we have known how to measure filter. The following examples will show other measurements.

3.4.1. Measuring CATV amplifier

3.4.1.1 Parameters of measuring CATV amplifier

The major parameters of CATV amplifier include gain, flatness, impedance, return loss, delay, CTB (composite triple beat), CSO (Composite Second Order Beat), CM (cross modulation), NF (noise figure) and etc.

The parameters of gain, flatness, impedance, return loss, delay should be measured by vector network analyzer. The parameter of CTB, CSO, CM and NF should be measured by spectrum analyzer and other instrument.

The analyzer has an RF signal source that produces an incident signal that is used as a stimulus to the DUT (Device under Test). The device reflects a portion of the incident signal and transmits through the remaining signal. The forwards transmitted signal (routed to channel B) and the reflected signal (input channel A) are measured by comparison to the incident signal. The analyzer couples off a small portion of the incident signal to use as a reference signal (routed to channel R). Sweeping the source frequencies, the analyzer measures and displays the response (gain or return loss) of DUT.

3.4.1.2 Calibration kits for measuring

For measuring gain, flatness, the THRU standards and cables are enough. If measuring the impedance or return loss, we need perform a one-port calibration and need calibration kits including OPEN, SHORT, LOAD standards. According to different types of connectors, you may need suitable adapters and calibration kits.

Usually, the input and output ports of CATV amplifier are type F. Measuring insertion loss and gain need two cables which are type N to type F (metric or imperial) and a F-F through adapter.

Measuring return loss and impedance need one cables which are type N to type F, 2 or 3 F type load(male), F type F open (female), short(female), load(female).

3.4.1.3 Notes

- 1. The amplifier has normal input level range; the output signal level of network analyzer should not exceed the range. If the level of input signal is too high, it will cause gain compression and error.
- 2. Except input and output port, the CATV amplifier has a test port and other ports. When measuring return loss, we should terminate these ports with LOAD standard to reduce the signal reflect back.
- 3. After withstanding impulse voltage test, you must discharge the CATV amplifier, and then you can connect the amplifier with the network analyzer, otherwise the high voltage will damage the receiver of the network analyzer.
- 4. While 50 Ω and 75 Ω type-N connectors are similar in appearance, they are not compatible. 75 Ω type-N connectors have a smaller center pin. Connector damage can result if you attach a 50 Ω male connector to a 75 Ω female connector.
- 5. The unit of signal level is dBm or dBmW, not dBmV, 0dBm=108.75dB μ V(75 Ω type)

3.4.1.4 Measuring the parameter

3.4.1.4.1 Preparation before measurement

- 1. The ground of the DUT must connect to the ground of analyzer so that It can protect the operator and also avoid cause device damage.
- 2. The analyzer will become stable 10 minutes after the instrument has been turned on. And then you can calibrate and measure.

3.4.1.4.2 Measuring gain and flatness

1. Measuring flatness

Measuring flatness we should measure the transmission of the CATV amplifier. Connect the DUT to input and output ports of the analyzer, and readout the maximum and minimum value, Calculates the difference between the maximum value and the minimum value and divide by 2 is flatness



Figure 3-11 Measuring Flatness



Figure 3-12 Test Connection For Transmission

Procedure

 Step 1, for measuring transmission, press
 CHAN PREV
 CHAN NEXT
 select channel 2 (you can select any channel), press

 MEAS
 , and press[Transmission].Select chan2 to be transmission method.

 Step 2, press
 START
 , press
 4
 , 6
 , and then press
 M/u
 . Start frequency is 46MHz.

 Step 3, press
 STOP
 , press
 9
 , 0
 , 0
 , and then press
 M/u
 . Stop frequency is 900MHz.

Step 4, press SWEEP SETUP , select [Power], entry next menu, press [Power], and then press Power/Low

- Step 5, use two N-F cables connect the input and output port of the analyzer. Use a F-F THRU standard to connect two cables. Press CAL , select [Normalize], then we have corrected for errors caused by the signal path.
- Step 6, connect the DUT as figure 3-12 shown.
- *Step 7*, press MARKER, turn [marker 1] to ON, active the marker 1, press MARKER SEARCH , and then press [MAX] to select the max marker of the transmission trace. Marker1 auto search the maximum amplitude point in the frequency range.
- *Step 8*, press MARKER, turn [marker 2] to ON, active the marker 2, press MARKER SEARCH , and then press [MIN] to select the MIN. marker of the transmission trace. Marker1 auto search the minimum amplitude point in the frequency range.
- Step 9, calculate the difference between the marker 1 and the marker 2. The difference between markers 1 and 2 and divided by 2 is flatness. Shown as figure 3-11
- Step 10, press MARKER, active any markers on, and then rotate the knob to move the marker to the frequency point you are interesting. The Marker value is the gain of the current frequency. Shown as figure 3-13



Figure 3-13 Measuring Gain

3.4.1.4.3 Measuring return loss



Figure 3-14 Test Connection for Reflection

CATV system requests the impedance of device to be 75Ω . Ideally, with device completely match, return loss is zero. In fact, completely match is impossible. Return loss indicates mismatch of the device.

Example

 Step 1, For measuring return loss, press
 CHAN PREV
 CHAN NEXT
 , select channel 1(you can select any channel) , press

 MEAS
 , and press the item[Reflection]. Chan2 is reflection method.



Step 3, press	STOP	, press	9	,	0	,	0	, and then press	M/u	. Stop frequency is 900MHz
---------------	------	---------	---	---	---	---	---	------------------	-----	----------------------------

- Step 4, press SWEEP SETUP and [Power], entry next menu, select [Power], and then press Power/Low
- Step 5, Press CAL, select[Reflection] to entry the next menu. The next menu includes four items [Open], [Short], [Load] and [Done].
- Step 6. Connect a N-F 75Ω cable to RF output port of the network analyzer. F connector of the N-F cable is the port for measuring amplifier. So we need execute calibration at this port. After calibration, the error of the result will decrease. If executing calibration at the port of the analyzer, and then connect a cable to measuring device, the influence of the cable should not be ignored. The correct method is to exec calibration at the end of the cable using female F type calibration kits before measurement.
- Step 7. Connect the OPEN standard to the cable, press[Open]; connect the SHORT standard to the cable, press[Short]; connect the OPEN standard to the cable, press[Load], and press[Done].Only pressing [Done], the calibration is finished; if not, calibration is invalid. The sequence of OPEN, SHORT, LOAD is not necessary.
- **Step 8.** Except input and output port, the CATV amplifier may has a test port and other ports. When measure DUT, we should connect loads on the other no use ports avoiding the signal reflect back to make error.
- Step 9, Connect the amplifier measured to the F end of the cable. The network analyzer will display the trace on the screen. Press MARKER , press [Marker 1], turn on the marker 1, and then turn on marker 2, marker 3, marker 4, marker 5. Rotate the knob to change the frequency points you want to measure, and then record the data. Shown as figure 3-15



Figure 3-15 Measuring Return Loss



Figure 3-16 Test Connection for Cable Loss

3.4.2. Measuring CATV splitter

3.4.2.1 Parameters of measuring CATV splitter

The parameters of splitter include flatness, insertion loss, isolation, return loss, and etc.

Measuring CATV splitter is similar to measuring CATV amplifier. This section does not explain the detail. Just introduce the method and cautions



Figure 3-17 Connection For Measuring Splitter

(1) Isolation:

It means the isolation between the difference output ports of splitter. Connect the output port of the analyzer to one output port of the splitter with cable; connect another port of the splitter to the input port of the analyzer. Then measure the transmission characteristic between the two output ports.

(2) Insertion loss:

It means the attenuation between the input port and every output port of the splitter. Connect the output port of the analyzer to input port of the splitter. Connect another port of the splitter to the input port of the analyzer. Measure the transmission characteristic between the two output ports.

(3) Branch isolation:

It means the difference level between the input level of the main branch and the branch output level. Measurement will be network analyzer output from the input end of the splitter, the network analyzer input received from the branch output end of the splitter. Branch is inversely proportional to the loss and the insertion loss, and related to the number of branch interface.

(4) Reverse isolation:

Reverse the input and output of the splitter as measuring isolation. Measure the transmission characteristic between the two output ports.



Figure 3-18 Measuring Branch loss



Figure 3-19 Measuring Isolation

3.5. Optimize measurements

This chapter describes how to get better measurement result

- Maintenance of Test Ports and Connectors
- Optimizing measurement accuracy
 - ♦ Cable connection
 - ♦ Calibration
 - ♦ Proper sweep time for long electrical length DUT
 - ♦ Connector Repeatability Errors
 - ♦ Frequency drift
 - ♦ Operation temperature drift
 - ♦ Calibration reference plane and Port Extension
- Measure the DUT with long electrical length
- Expanding dynamic range
- Eliminate measurement noise

3.5.1. Maintenance of Test Ports and Connectors

It is very important to maintain the test ports and connectors. It is helpful to improve the operation life and get more accuracy result.

OPERATION and STORE VNA				
Always keep the connectors free from stains and	Touch the contact surface on the connectors.			
dust.				
Cover the test ports when storing \ the VNA				
Check				
Check ports and connectors carefully	Do not use bad ports and Connectors			
Check metal dross in the ports and connectors				
Clean the surface				
Using alcohol	Do not use abrasives under any circumstance.			
Clean surface and screw thread				
Connection				
Do not plug damaged or scratched connectors into the test ports.				

Table 3-1

3.5.2. Optimizing measurement accuracy

This topic lists the measurement errors.

3.5.2.1 Cable connection

The cable connecting between VNA and DUT will cause random errors. So the user operation as below eliminates the errors caused by cable.

- Check if the connector is damaged;
- Maintenance of test ports and connectors as table 3-1
- Keep the cable same position between calibration and measurement procedure
- If possible, please use Low Loss, Phase Stable Cable

3.5.2.2 Wrong calibration

Wrong calibration will cause a great system error. So user should calibrate the VNA carefully before measurement.

- Verify the calibration kits (OPEN, SHORT, LOAD, THROUGH)
- Execute the calibration correctly

3.5.2.3 Proper sweep time for long electrical length DUT

If sweep time is too short, it will cause test errors when measure the DUT with long electrical length, so please set longer sweep time to fit the electrical length.

3.5.2.4 Connector Repeatability Errors

Connector repeatability errors are caused by fluctuations in the electrical characteristics of connectors due to wear. These errors may be reduced by handling connectors with care. So user should do something as below before measurement.

- Check the connectors
- Clean the connectors
- Connect the connectors correctly

3.5.2.5 Operation temperature drift

Electrical characters will be changed as the temperature changes. So keep operation constant temperature is very important. It is recommended to operate the VNA in $25^{\circ}C\pm 5^{\circ}C$.

3.5.2.6 Frequency drift

Frequency drift will cause measurement errors. It is important to use higher frequency reference option to get higher accuracy frequency.

3.5.3. Measure the DUT with long electrical length

When measuring these DUT with long electrical length (for example, long length cable, SAW filter), the VNA needs some special configurations. The long electrical length need long sweep time. If the sweep time is too short, the frequency response of DUT cannot be achieved properly. So it will cause more errors. So enlarge the sweep time will get correct result. This topic will explain how to get better measurement result when test DUT with long electrical length.

1. The reasons that cause errors

When test DUT with long electrical length, the signal frequency between the input and output of DUT is different. When a signal propagate in a long electrical length DUT, it will cause frequency offset (Δ F). So the input signal frequency is a little different (Δ F) from the receiver of VNA. The VNA have some test error for the Δ F. If the sweep time is longer, the Δ F is smaller, the errors is smaller. So longer sweep time is helpful to eliminate the errors.

2. Get better result

To eliminate the errors, the ΔF must be lower as below

longer sweep time

3.5.3.1 Longer sweep time

Push SWEEP SETUP [sweep time/MNL] to enter longer sweep time.

There is another solution. If keep the frequency span, and then increase the sweep points, it will decrease the frequency deviation point to point (GHz/s).

According to the DUT, user could select proper sweep time. The longer the electrical length is, the longer the sweep time.

3.5.4. Improve sweep time

- 1. Decrease sweep frequency span if possible
- 2. Set the sweep time to AUTO method
- 3. Increase RBW
- 4. Decrease AVG factor
- 5. Decrease sweep points

3.5.4.1 Set sweep time to AUTO method

AUTO method is default. AUTO method is the fastest time with the current configuration.

• Push SWEEP SETUP [Sweep Time/AUTO], to enable AUTO.

3.5.4.2 Increase RBW

- Push AVG [IF RBW]
- Increase the RBW value

3.5.4.3 Decrease AVG factor

Sweep time can be shortened via decrease AVG factor or turn AVG off.

- Push AVG
- Push AVG factor Increase AVG factor.
- Or turn AVG off. Switch Averaging to OFF

3.5.4.4 Decrease sweep points

- Push Sweep setup [points];
- Decrease points. VNA supports 101, 201, 251, 401, 501, 801, 1001 and 1601 points.

3.5.4.5 Displaying single trace

If the CH. coupled mode is off, sweep time will be short when display single trace.

- Sweep setup [CH coupled] = off
- Push CHAN PREV or CHAN NEXT to select the current channel
- Push DISPLAY [DUAL (ON/OFF)] = OFF.

3.5.5. Expanding dynamic range

The dynamic range is the finite difference between the maximum input power level and the minimum measurement power level (noise floor) of the analyzer. In evaluating a characteristic accompanied by a large change in the amplitude (the pass band and stop band of a filter), for example, it is important to increase the dynamic range. This topic explains how to expanding the dynamic range.

3.5.5.1 Improve the maximum input power level

3.5.5.2 Eliminate measurement noise floor

See next 3.5.6

3.5.6. How to eliminate measurement noise floor

The following methods can be used to lower the receiver noise floor.

- 1. Turn on Averaging
- 2. Narrowing the IF Bandwidth

3.5.6.1 Turn on Averaging

Using sweep averaging also enables you to reduce the effects of random noise on measurements.

- Push AVG [AVG STAT] = ON
- Push [AVG Factor] and enter a AVG factor

3.5.6.2 Narrowing the IF Bandwidth

Narrowing the receiver IF bandwidth enables to reduce the effect of random noise on measurements. Narrowing the IF bandwidth to 1/10 the original bandwidth causes the receiver noise floor decreasing by 10 dB.

- Push AVG [IF RBW]
- INPUT RBW value. The RBW = 50k/25k/12.5k/10k/6.25k/5k/2.5k/2k/1.25k/1k

The narrower RBW, the longer sweep time.

3.6. Calibration

It is very important to calibrate the VNA before measure the DUT.

Every VNA has calibration program. It is helpful to improve accuracy. This chapter describes the calibration process to use with Deviser VNA

3.6.1. Precautions

- 1. Before calibration, the VNA must be turned on at least 30 minutes.
- 2. For reflection calibration, The VNA must be calibrated on the terminal of the DUT, not the port of the VNA.
- 3. When change the sweep points, power, and frequency, the VNA must be re-calibrated.

3.6.2. Normalization calibration

Normalization calibration is simple to perform, but only corrects for a few errors (tracking errors)

In normalization calibration, calibration data are measured by connecting a THRU standard to the desired test port. This calibration effectively eliminates the frequency response transmission tracking error from the test setup in a transmission test using that port.

Procedure

- Step1 Set the test parameters (frequency, sweep points, power, RBW and etc.)
- Step2 Press CAL
- Step3 Connect test cable and THRU on the VNA port.
- Step4 Press Normalize(THRU) to exec the calibration.

After calibration, the calibrated channel will be add a marker as "+Cor".

NOTE:

1. If using customized test fixture, user should calibrate the test path include the fixture.

2. Normalization calibration is only used in Transmission test mode

3. If the test parameters(frequency, sweep points, power, RBW and etc.) are changed, the VNA must be re-calibrated.

3.6.3. 1-port calibration

In 1-port calibration, calibration data are measured by connecting an OPEN standard, a SHORT standard, and a LOAD standard to the desired test port. This calibration effectively eliminates the frequency response reflection tracking error, directivity error, and source match error from the test setup in a reflection test using that port as figure 3-20



Figure 3-20 1-Port Error Model

Procedure

	Step1	Set the test parameters (frequency, sweep points, power, RBW and etc.)		
	Step2	Press CAL		
	Step3	Press Reflection		
	Step4	Connect an OPEN calibration standard to the test port (connector to which the DUT will be connected)		
	Step 5	Press Open to start the calibration measurement.		
	Step 6	Connect a SHORT calibration standard to the test port (connector to which the DUT will be connected)		
	Step 7	Press Short to start the calibration measurement.		
	Step 8	Connect a LOAD calibration standard to the test port (connector to which the DUT will be connected)		
	Step 9	Press Load to start the calibration measurement.		
	Step 10	Press Done to terminate the 1-port calibration process. Upon pressing the key, calibration		
Coe	Coefficients will be calculated and saved. The error correction function will also be automatically enabled.			

After calibration, the calibrated channel will be add a marker as "+Cor". Step1

Directivity error (Ed)

Directivity errors are caused by the fact that in a reflection measurement, signals other than the reflection signal from the DUT are received by receiver through the directivity coupler. When a certain port is a stimulus port, this error can be defined as a constant value for each stimulus port because the state of the termination at the other ports does not change.

Source match error (Es)

A source match error is caused because the reflection signal of the DUT reflects at the signal source and enters into the DUT again. When a certain port is a stimulus port, this error can be defined as a constant value for each stimulus port because the state of the signal source switch does not change. The number of source match errors of the VNA is the number of stimulus ports you use.

Reflection tracking error (Er)

A reflection tracking error is caused because the difference in frequency response between the test receiver and the reference receiver of a stimulus port in reflection measurement. This error can be defined as a constant value for each stimulus port because the combination of the test receiver and the reference receiver of a stimulus port is always the same. The number of reflection tracking errors of the VNA is the number of stimulus ports you use.

NOTE:

- 1. If using customized test fixture, user should calibrate the test path include the fixture.
- 2. Only be used in Reflection test mode
- 3. If the test parameters (frequency, sweep points, power, RBW and etc.) are changed, the VNA must be re-calibrated.

4. Programmer Guide

- SCPI Basics
- LAN Remote Control System
- SCPI Command List

TA7100/TA7300 can be remote controlled by Workbench software via LAN port. Workbench controls several TA7100/TA7300s simultaneously. Workbench provides 3 functions. First is remote control the instrument; second is access the measurement data (trace, marker...) from the instrument; and the last one is generating measurement report table. Operator can do everything remotely, same as operating the instrument.

TA7100/TA7300 provides standard SCPI program command. So operator can program his own software to control the machine and get the measurement result automatically.

4.1. SCPI Basics

4.1.1. Descriptions

- (1) TA7100/TA7300 adopts standard SCPI (Standard Commands for Programmable Instruments) command.
- (2) This chapter describes the SCPI syntax.
- (3) Below it is the referenced documents.

IEEE Standard 488.1-1987, IEEE Standard Digital Interface for Programmable Instrumentation. New York, NY, 1998.

IEEE Standard 488.2-1987, IEEE Standard Codes, Formats, Protocols and Comment Commands for Use with ANSI/IEEE Std488.1-1987. New York, NY, 1998.

4.1.2. Commands Structure

The commands consist of a so-called header and usually one or several parameters. Header and parameters are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, eg space = 32 decimal). The headers may be composed of several keywords. The query form is generated by appending a question mark directly to the header. Example: SENSe[1|2]:FREQuency:STARt 1.5 MHZ

The instrument does not differentiate between lowercase and uppercase characters. In this manual, the short form uses uppercase characters, whereas the long form gives the whole keyword.

Example: Sens:1Freq:Star 1.5 mhz

SENSE1:FREQ:start 1.5 MHz

The two commands is same meaning.

NOTE

The command below is incorrect: SENS:FREQU:STAR The reason is that "FREQU" is not the right keyword.

4.1.3. SC(Special Characters) list

SC	Meaning	Examples
Ι	A vertical bar in the notation of the parameters is used to separate alternative options and is to be seen as an "or". The effect of the command differs according to the parameter state	TRIGger: CONT HOLD SING CONT, HOLD and SING is two choice. TRIG:CONT is one sweep mode.
[]	Keywords in square brackets may be omitted in compound headers. Parameters in square brackets may also be optionally inserted into the command or omitted.	SOUR[1 2]:POW:STAR <1.5> [dBm] SOUR1:POW:STAR 1.5 dBm SOUR1:POW:STAR 1.5 The 3 commands is same meaning.
<>	Characters enclosed in this pair of symbols are necessary parameters when sending the command	SENS:FREQ:STAR <freq>, <freq> means the frequency parameter. Example SENS:FREQ:STAR <9.7MHz></freq></freq>

4.1.4. Parameters

There are four types of parameter: Boolean, Character strings, Numeric values and Binary data.

(1) Boolean parameter: OFF|ON|0|1

Boolean parameters represent two states. The ON state (true condition) is represented by ON or a nonzero numeric value. The OFF state (false condition) is represented by OFF or the value of 0. Queries always return 0 or 1.

Example: SENS:COUP ON. The command means the channel is coupled.

(2) Character string:

Some commands have special character string parameter.

Example:

- AUTO automatically
- MANU manually
- (3) Numeric values

Numeric values may enter any customary form, i.e. with sign, decimal point and exponent. If the values exceed the resolution of the instrument, they will be rounded off. The mantissa may comprise up to 255 characters, and the exponent must be in the range between -32 000 and 32 000. The exponent is denoted by an "E" or "e". The exponent alone must not be used. Physical quantities may be stated with the unit. Permissible prefixes for the unit are G (Giga), MA (Mega, MOHM and MHZ are also allowed), K (Kilo), M (Milli), U(Mikro) and N (Nano). If no unit is specified, the basic unit will be used.

Parameter	Meaning	Data type	Unit	Default
<integer></integer>	Integer data	Integer		
<real></real>	Decimal fraction	Float		
<freq></freq>	Frequency	rational number	Hz, kHz, MHz, GHz.	Hz
<ampl></ampl>	Amplitude	rational number	dBm, dBmV, dBμV, mV	dBm

Parameter	Meaning	Data type	Unit	Default
<percent></percent>	percent	0-100	PCT	РСТ
<string></string>	Character	Char		

(4) Binary data

<arbitrary block data> parameter represents binary data. Binary data is different from other three types of parameters. When transferring the trace data, the binary data parameter is very useful. It supports high speed data exchange between the machine and controller.

The ASCII character # denotes the beginning of the data block. The next number specifies the number of subsequent digits defining the length of the data block.

Example: #512320XXXXX

The five digits specify a length of 12320bytes.

4.2. LAN remote control system

4.2.1. Connection

There are two connection modes between machine and PC. The first connection is via crossover Line, and another one uses a straight through cable for connection via a router or network switch.





EIA/TIA standard define two types of crossover line: 568B and 568A, shown as the table:

No.	568A	568B
1	Green-white	Orange-white
2	Green	Orange
3	Orange-white	Green-white
4	Blue	Blue
5	Blue-white	Blue-white
6	Orange	Green
7	Brown-white	Brown-white
8	Brown	Brown

The line sequences of the two ends of the straight through cable are the same, both are 568A or 568B; for crossover cable, one end is 568A, the other one is 568B. Pin 1 and 3 are reversed; pin 2 and 6 is reversed.

Straight through cable	Crossover cable
1 <> 1	1 <> 3
2 <> 2	2 <> 6
3 <> 3	3 <> 1
4 <> 4	4 <> 4
5 <> 5	5 <> 5
6 <> 6	6 <> 2

Straight through cable	Crossover cable
7 <> 7	7 <> 7
8 <> 8	8 <> 8

The figure 4-1 and figure 4-2 are very simple connections. In fact, a PC can connect a lot of VNA simultaneously via a router or network switch. It is shown as figure 4-3



4.2.2. Commands descriptions

Sending or receiving a command ends with enter key, and binary key is 0x0d, 0x0a

Example: sending a command to get the ID code, *IDN?

In fact, sending a serial words is"*IDN?/0x0d/0x0a".

In command, '?' means return some data. It is a command to control the machine without '?'.

The program deploys standard Socket protocol. Some commands will transfer a lot of data. For example, TRAC? CH1FDATA, The command will receive the trace data of the current channel, and it will return 1602 points double float data, additional file header #512816 and file end 0x0d 0x0a, total 12825 bytes data. In UDP/IP format, MTU is 1500 bytes. So the trace data will be sent via different packets.

4.3. Commands list

4.3.1. General commands

Command	Meaning	Input/Output
*RST	Software reset	
*IDN?	Get machine ID number	Character
	Get machine options	FILT <on off>, filter analysis option</on off>
*OPT?	information	CONV <on off>, data conversion option</on off>
		SRL <on off>,</on off>

Example: Get ID number

Command: *IDN?

Return result: VNA, TA7300, Deviser, 000101986, ARM:1.2.2, DSP:1.3.1

4.3.2. System status command

Command	Meaning	Input/output
SYST:LANG <en cn></en cn>	Select language	English Chinese
SYST:LANG?	Get the current language	EN CN
	setting	
SYST:DATE < integer >	Set date	Year month day, example 2013,01,23
SYST:DATE?	Get date	Year month day, example 2013,01,23
SYST:TIME < integer >	Set time	Hour minute second, example 15,31,33
SYST:TIME?	Get time	Hour minute second, example 15,31,33
SYST:BEEP:CAUT <on off></on off>	Set beep caution	ON OFF
SYST:BEEP:CAUT?	Get beep caution status	ON OFF
TEST:BEEP:CAUT	Test beep caution	
SYST:BEEP:ALAR <on off></on off>	Set beep alarm	ON OFF
SYST:BEEP:ALAR?	Get beep alarm status	ON OFF
TEST:BEEP:ALAR	Test beep alarm	
TEST:DISP	Test displaying	

Example: get time from VNA

Command: SYST:TIME?

Return result: 12, 06, 10

It is represents that VNA time is 12h 06m 10s

Example: set current time =12h 07m 00s

Command is: SYST:TIME 12,07,00

4.3.3. SAVE/RECALL VNA status

Command	Meaning	Input/output
MMEM:STOR:STAT <'file'>	Save status to file	The max length of file name is 12
		chars
MMEM:LOAD:STAT <'file'>	RECALL status from file	The max length of file name is 12
		chars
MMEM:STAT:TOTA?	Get quantity of status files	quantity
MMEM:STAT[1 2]:NAME?	Get the name of the file	Chars
MMEM:STAT:TYPE <stat s&c s&t all></stat s&c s&t all>	Set the type of configure file	status status&calibarion status&trac
		e all
MMEM:STAT:TYPE?	Get the type of files	STAT S&C S&T ALL

4.3.4. Frequency

Command	Meaning	Input/output
SENS[1 2]:FREQ:STAR <num> [GHZ MHZ KHZ HZ]</num>	Set start frequency	Frequency
SENS[1 2]:FREQ:STAR?	Get start frequency	Frequency
SENS[1 2]:FREQ:STOP <num> [GHZ MHZ KHZ HZ]</num>	Set stop frequency	Frequency
SENS[1 2]:FREQ:STOP?	Get stop frequency	Frequency
SENS[1 2]:FREQ:CENT <num> [GHZ MHZ KHZ HZ]</num>	Set center frequency	Frequency
SENS[1 2]:FREQ:CENT?	Get center frequency	Frequency
SENS[1 2]:FREQ:SPAN <num> [GHZ MHZ KHZ HZ]</num>	Set frequency span	Frequency
SENS[1 2]:FREQ:SPAN?	Get frequency span	Frequency

Example: Set center frequency for channel 1 = 300.33 MHz Command: SENS1:FREQ:CENT 300.33 MHz

4.3.5. Power

Command	Meaning	Input/output
SOUR[1 2]:POW		
<normal -5dbm -10dbm -15dbm -20dbm -25dbm < td=""><td>Set output power</td><td>NORMAL/-5/-10/-15/</td></normal -5dbm -10dbm -15dbm -20dbm -25dbm <>	Set output power	NORMAL/-5/-10/-15/
-30DBM>		-20/-25/-30dBm
SENS[1 2]:POW?	Get output power	
OUTP <on off></on off>	Set power on/off	ON OFF
OUTP?	Get power on/off	ON OFF

4.3.6. Sweep

Command	Meaning	Input/output
SENS[1 2]:SWE:TIME <num> [ms s]</num>	Set sweep time	Sweep Time
SENS[1 2]:SWE:TIME?	Get sweep time	Sweep AUTO
SENS[1 2]:SWE:TIME AUTO	Set sweep time = AUTO	AUTO
SENS[1 2]:SWE:POIN <num></num>	Set sweep points	Points
SENS[1 2]:SWE:POIN?	Get sweep points	Points
TRIG[1 2]: <cont hold sing></cont hold sing>	Set trigger mode	CONT HOLD SING
TRIG[1 2]?	Get trigger mode	CONT HOLD SING
TRIG:SOUR <inte manu></inte manu>	Set trigger source	INTE MANU
TRIG:SOUR?	Get trigger source	INTE MANU
SENS:COUP <on off></on off>	Set channel couple status	ON OFF
SENS:COUP?	Get channel couple status	ON OFF

Example: Set sweep points of channel 1 = 201

Command is: SENS1:SWE:POIN 201

Example: Set sweep mode of channel 2 = log

Command is: SENS2:SWE:TYPE LOG

4.3.7. Set channel function

Command	Meaning	Input/output
SENS[1 2]:FUNC'XFR:POW:RAT 2,0'	Set to transmission channel	
SENS[1 2]:FUNC'XFR:POW:RAT 1,0'	Set to reflection channel	
SENS[1 2]:FUNC'XFR:POW:RAT 2,0'	Set to B/R	
SENS[1 2]:FUNC'XFR:POW:RAT 1,0'	Set to A/R	
SENS[1 2]:FUNC?	Get function of current channel	'XFR:POW:RAT 2,0'

Example: Set channel1 function = transmission

Command is: SENS1:FUNC'XFR:POW:RAT 2,0'

4.3.8. Data Format

Command	Meaning	Input/output
CALC[1 2]:FORM MLOG	Set for log Magnitude	
CALC[1 2]:FORM PHAS	Set for phase	
CALC[1 2]:FORM GDEL	Set for group delay	
CALC[1 2]:FORM SWR	Set for VSWR	
CALC[1 2]:FORM SMIT	Set for smith chart	
CALC[1 2]:FORM IMP	Set for impedance amplitude	
CALC[1 2]:FORM POL	Set for polar chart	
CALC[1 2]:FORM MLIN	Set for linear magnitude	
CALC[1 2]:FORM REAL	Set for real part	
CALC[1 2]:FORM IMAG	Set for imaginary part	
CALC[1 2]:FORM?	Get data FORMAT	MLOG PHAS

Example: Set data format of channel 2 = phase

Command is: CALC2:FORM PHAS

4.3.9. SCALE

Command	Meaning	Input/Output
DISP[1 2]:WIND:TRAC:Y:AUTO	Exec auto scale	
DISP[1 2]:WIND:TRAC:Y:PDIV <num></num>	Set /DIV	
DISP[1 2]:WIND:TRAC:Y:PDIV?	Get /DIV	
	Sets the value of the reference	
DISP[1]2].WIND.TRAC.T.RLEV <num></num>	graticule line.	
DISP[1 2]:WIND:TRAC:Y:RLEV?	Get reference line	
DISP[1 2]:WIND:TRAC:Y:RPOS <num></num>	Set reference position	
DISP[1 2]:WIND:TRAC:Y:RPOS?	Get reference position	
DISP[1 2]:WIND:TRAC:Y:DIVI <4 6 8 12 14 16 18 20>	Set the number of divisions of all	Even number, 4 \sim 20
	the graphs of channel	
DISP[1 2]:WIND:TRAC:Y:DIVI?	Get the number of divisions of all	4 6 8 12 14 16 18 20
	the graphs of channel	

Example: Set /DIV of channel1 = 10.5 dB

Command is: DISP1:WIND:TRAC:Y:PDIV 10.5 dB

4.3.10. Displaying

Command	Meaning	Input/Output
DISP:WIND:DUAL <on off></on off>	Set display method of signal/ double channel	ON OFF
DISP:WIND:DUAL?	Get display method of signal/ double channel	ON OFF
DISP:WIND:SPL <on off="" =""></on>	Set display method to split or not	ON OFF
DISP:WIND:SPL?	Get display method to split or not	ON OFF
DISP[1 2]:SOUR <data mem d&m off></data mem d&m off>	select display trace method	data memory data
		+memory off
DISP[1 2]:SOUR?	Get display trace method	DATA MEM D&M OFF
TRAC CH[1 2]SMEM, CH[1 2]SDATA	Save data to memory	
DISP[1 2]:MATH <off * - +=""></off >	Set math method of trace	OFF / * - +
DISP[1 2]:MATH?	Get math method of trace	OFF / * - +
DISP[1 2]:WIND:GRID <on off></on off>	Set graticule line on off	ON OFF
DISP[1 2]:WIND:GRID?	Get graticule line on off status	ON OFF
DISP[1 2]:WIND:PROM <on off></on off>	Set the graticule value display on off	ON OFF
DISP[1 2]:WIND: PROM?	Read the graticule value display method	ON OFF
DISP:COLO:BG <num, num="" num,=""></num,>	Set the screen background color	R,B value: 0 \sim 31
		G value: 0 \sim 63
DISP:COLO:BG?	Get the screen background color	R,G,B
DISP:COLO:MEAS <num, num="" num,=""></num,>	Set the measurement background color	
DISP:COLO:MEAS?	Get the measurement background color	
DISP:COLO:TEXT <num, num="" num,=""></num,>	Set text color	
DISP:COLO:TEXT?	Get text color	
DISP:COLO:GRID <num, num="" num,=""></num,>	Set the color of the grid line of the graph	
DISP:COLO:GRID?	Get the color of the grid line of the graph	
DISP:COLO:BORD <num, num="" num,=""></num,>	Set the color of the outer frame line of the graph	
DISP:COLO:BORD?	Get the color of the outer frame line of the graph	
DISP:COLO:TR1 <num, num="" num,=""></num,>	Set the color of the data trace1	
DISP:COLO:TR1?	Get the color of the data trace1	
DISP:COLO:TR2 <num, num="" num,=""></num,>	Set the color of the data trace2	
DISP:COLO:TR2?	Get the color of the data trace2	
DISP:COLO:MEM1 <num, num="" num,=""></num,>	Set the color of the memory trace1	
DISP:COLO:MEM1?	Get the color of the memory trace1	
DISP:COLO:MEM2 <num, num="" num,=""></num,>	Set the color of the memory trace2	
DISP:COLO:MEM2?	Get the color of the memory trace2	
DISP:COLO:LIM <num, num="" num,=""></num,>	Set the color of the limit line	
DISP:COLO:LIM?	Get the color of the limit line	
DISP:COLO:RESE	Reset the display color settings for all the items	
	to the factory preset state	
DISP:COLO:INVE <on off></on off>	Set inverted display	ON OFF
DISP:COLO:INVE?	Get inverted display status	ON OFF
DISP:STYL < MODE SALU CLAS >	Set display style	MODE SALU CLAS

Command	Meaning	Input/Output
DISP:STYL?	Get display style	MODE SALU CLAS

Example: Set the display to inverted mode

Command is: DISP:COLO:INVE ON

4.3.11. Data Average

Command	Meaning	Input/Output
SENS[1 2]:AVER <on off></on off>	Turn average on or off	ON OFF
SENS[1 2]:AVER?	Get average status	ON OFF
SENS[1 2]:AVER:COUN <num></num>	Set averaging factor	1~999
SENS[1 2]:AVER:COUN?	Get averaging factor	1~999
SENS[1 2]:AVER:CLE	Restart averaging	
CALC[1 2]:GDAP:APER <num></num>	Set aperture of group delay	0.1%~20.0%
CALC[1 2]:GDAP:APER?	Get aperture of group delay	0.1%~20.0%
SENS[1 2]:SMO <on off></on off>	Turn trace smoothing on or off	ON OFF
SENS[1 2]:SMO?	Get trace smoothing status	ON OFF
SENS[1 2]:SMO:APER <num></num>	Set trace smoothing aperture	0.1%~20.0%
SENS[1 2]:SMO:APER?	Get trace smoothing aperture	0.1%~20.0%
SENS[1 2]:BWID <num> [KHZ HZ]</num>	Set RBW	BW value
SENS[1 2]:BWID?	Get RBW value	Auto

Example: Set the smoothing aperture of channel 1 = 2.0%

Command is: SENS1:SMOO:APER 2.0%

4.3.12. Calibration

Command	Meaning	Input/Output
SENS[1 2]:CORR:COLL:THRU	Measure the calibration data of the thru standard from	
	the stimulus port to the response port.	
SENS[1 2]:CORR:COLL:OPEN	Measure the calibration data of the open standard of the	
	specified port	
SENS[1 2]:CORR:COLL:SHOR	Measure the calibration data of the short standard of	
	the specified port	
SENS[1 2]:CORR:COLL:LOAD	Measure the calibration data of the load standard of the	
	specified port	
SENS[1 2]:CORR:COLL:SAVE	From the measured calibration data, calculate the	
	calibration coefficients of reflection trace.	
SENS[1 2]:CORR OFF	Exit of calibration process	
SENS[1 2]:CORR?	Get calibration status	ON OFF
SENS[1 2]:CORR:TYPE APPR STAN	Set calibration type	
SENS[1 2]:CORR:TYPE?	Get calibration type	

Command	Meaning	Input/Output
SENS:CORR:IMP <num> [OHM]</num>	Set system impedance	Impedance 1 \sim 1000
SENS:CORR:IMP?	Get system impedance	

4.3.13. Marker

Command	Meaning	Input/Output
CALC[1 2]:MARK[1 2 3 4 5 6 7 8] <on off></on off>	Turn marker on or off	ON OFF
CALC[1 2]:MARK[1 2 3 4 5 6 7 8]?	Get marker on or off	ON OFF
	Get current marker	0~8,
CALC[1 2]:MARK:CURR?		0 represent no
		active marker
CALC[1 2]:MARK:AOFF	Turn off all the markers	
CALC[1 2]:MARK[1 2 3 4 5 6 7 8]:X <num></num>	Set the frequency of the active marker	Frequency
[GHZ MHZ KHZ HZ]		
CALC[1 2]:MARK[1 2 3 4 5 6 7 8]:X <num> [dBm]</num>	Set the power of the active marker	Power
CALC[1 2]:MARK[1 2 3 4 5 6 7 8]:X?	Get the frequency/power and value of	Frequency/power,
	the active marker	Marker value
CALC[1 2]:MARK:MODE <ref abs></ref abs>	Set the mode of marker	Reference or normal
CALC[1 2]:MARK:MODE?	Get the mode of marker	REF ABS
CALE:MARK:COUP <on off></on off>	Set couple status of marker	ON OFF
CALE:MARK:COUP?	Get couple status of marker	ON OFF
CALC[1 2]:MARK:FUNC	Set marker function	Center Span Start Stop
<cent span star stop rlev></cent span star stop rlev>		Refernece
CALC[1 2]:FLAT <on off></on off>	Set flatness analysis on or off	ON OFF
CALC[1 2]:FLAT?	Get flatness analysis status	ON OFF
CALC[1 2]:FLAT:SPAN?	Get BW of flatness analysis	
CALC[1 2]:FLAT:GAIN?	Get gain of flatness analysis	
CALC[1 2]:FLAT:SLOP?	Get tilt of flatness analysis	
CALC[1 2]:FLAT:FLAT?	Get flatness of flatness analysis	
CALC[1 2]:STAT <on off></on off>	Turn the statistics on or off	ON OFF
CALC[1 2]:STAT?	Get the status of statistics	ON OFF
CALC[1 2]:STAT:SPAN?	Get BW of statistics	
CALC[1 2]:FLAT:MEAN?	Get average value of flatness statistics	
CALC[1 2]:FLAT:SDEV?	Get the deviation of flatness	
CALC[1 2]:FLAT:P-P?	Get the peak-peak value of flatness	
CALC[1 2]:MARK:FUNC <max min></max min>	Marker search	Max. Min.
CALC[1 2]:MARK:FUNC:TRAC <on off></on off>	Set marker trace	ON OFF
CALC[1 2]:MARK:FUNC:TRAC?	Get the status of marker trace	ON OFF

4.3.14. Analysis

Command	Meaning	Input/Output
SENS[1 2]:SRL <on off></on off>	Turn SRL on or off	ON OFF
SENS[1 2]:SRL?	Get the status of SRL	ON OFF
SENS[1 2]:FREQ:CUTO <num> [GHZ MHZ KHZ HZ]</num>	Set cutoff frequency	Frequency value
SENS[1 2]:FREQ:CUTO?	Get the cutoff frequency	
SENS[1 2]:CONV <on off></on off>	Turn data conversion on or off	ON OFF
SENS[1 2]:CONV?	Get the status of data conversion	ON OFF
SENS[1 2]:CONV:TYPE	Set the data conversion method	Z:transmission
<zref ztra s="" yref ytra 1=""></zref ztra >		Z:reflection
		Y: transmission Y:
		reflection 1/S
SENS[1 2]:CONV:TYPE?	Get the data conversion method	ZREF ZTRA
		YREF YTRA 1/S
CALC[1 2]:LIM:STAT <on off></on off>	Turn the limit line on or off	ON OFF
CALC[1 2]:LIM:STAT?	Get the status of limit line	ON OFF
CALC[1 2]:LIM:DISP <on off></on off>	Turn displaying limit line on or off	ON OFF
CALC[1 2]:LIM:DISP?	Get the status of displaying limit	ON OFF
	line	
CALC[1 2]:LIM:DISP:FAIL <on off></on off>	Turn the fail flag on or off	ON OFF
CALC[1 2]:LIM:DISP:FAIL?	Get the status of fail flag	ON OFF
CALC[1 2]:LIM:SEGM[1 2 12]:TYPE <lmax lmin loff></lmax lmin loff>	Set the method of limit line	LMAX LMIN LOFF
CALC[1 2]:LIM:SEGM[1 2 12]:TYPE?	Get the method of limit line	LMAX LMIN LOFF
CALC[1 2]:LIM:SEGM[1 2 12]:FREQ:STAR	Set the start frequency of limit line	Frequency value
<num> [GHZ MHZ KHZ HZ]</num>		
CALC[1 2]:LIM:SEGM[1 2 12]:FREQ:STAR?	Get the start frequency of limit line	Frequency value
CALC[1 2]:LIM:SEGM[1 2 12]:FREQ:STOP	Set the stop frequency of limit line	Frequency value
<num> [GHZ MHZ KHZ HZ]</num>		
CALC[1 2]:LIM:SEGM[1 2 12]:FREQ:STOP?	Get the stop frequency of limit line	Frequency value
CALC[1 2]:LIM:SEGM[1 2 12]:AMPL:STAR <num></num>	Set the start power of limit line	Power value
CALC[1 2]:LIM:SEGM[1 2 12]:AMPL:STAR?	Get the start power of limit line	Power value
CALC[1 2]:LIM:SEGM[1 2 12]:AMPL:STOP <num></num>	Set the stop power of limit line	Power value
CALC[1 2]:LIM:SEGM[1 2 12]:AMPL:STOP?	Get the stop power of limit line	Power value
CALC[1 2]:FILT:STAT <on off></on off>	Turn filter analysis on or off	ON OFF
CALC[1 2]:FILT:STAT?	Get the status of filter analysis	ON OFF
CALC[1 2]:FILT:PASS <num>dB</num>	Set XdB pass band	Frequency value
CALC[1 2]:FILT:PASS?	Get XdB pass band	Frequency value
CALC[1 2]:FILT:ATTE <num>dB</num>	Set XdB stop band	Frequency value
CALC[1 2]:FILT:ATTE?	Get XdB stop band	Frequency value

CALC[1 2]:FILT:USER <on off></on off>	Turn custom-built filter on or off	ON OFF
CALC[1 2]:FILT:USER?	Get the status of custom-built filter	ON OFF
CALC[1 2]:FILT:RIPP <num> [GHZ MHZ KHZ HZ]</num>	Set the ripple of pass band	
CALC[1 2]:FILT:RIPP?	Get the ripple of pass band	
CALC[1 2]:FILT:SEGM1:FREQ:STAR <num></num>	Set the start frequency of filter limit	
[GHZ MHZ KHZ HZ]	line of segment 1	
	Get the start frequency of filter	
CALC[1]2]:FILT:SEGMIT:FREQ:STAR?	limit line of segment 1	
CALC[1 2]:FILT:SEGM1:FREQ:STOP <num></num>	Set the stop frequency of filter limit	
[GHZ MHZ KHZ HZ]	line of segment 1	
	Get the stop frequency of filter limit	
CALC[1]2].FILT.SEGIVII.FREQ.STOP?	line of segment 1	
CALC[1 2]:FILT:SEGM2:FREQ:STAR <num></num>	Set the start frequency of filter limit	
[GHZ MHZ KHZ HZ]	line of segment 2	
	Get the start frequency of filter	
	limit line of segment 2	
CALC[1 2]:FILT:SEGM2:FREQ:STOP <num></num>	Set the stop frequency of filter limit	
[GHZ MHZ KHZ HZ]	line of segment 2	
	Get the stop frequency of filter limit	
	line of segment 2	
CALC[1 2]:FILT:LIM:STAT <on off></on off>	Turn the filter limit line on or off	
CALC[1 2]:FILT:LIM:STAT?	Get the status of filter limit line	ON OFF
	Turn the filter limit line displaying	ON OFF
	on or off	
	Get the status of filter limit line	ON OFF
	displaying	
CALC[1 2]:FILT:LIM:DISP:FAIL <on off></on off>	Turn fail flag of filter test on or off	ON OFF
CALC[1 2]:FILT:LIM:DISP:FAIL?	Get the status of fail flag	ON OFF
CALC[1 2]·FILT·LMAX·FREQ·CENT < num>	Set the center frequency of Max	
	limit line for filter analysis	
CALC[1 2]·ΕΙΙΤ·Ι ΜΑΧ·ΕΒΕΟ·CENT?	Get the center frequency of Max	
	limit line for filter analysis	
CALC[1 2]:FILT:LMAX:BW:PASS <num></num>	Set the Max pass band width	
CALC[1 2]:FILT:LMAX:BW:PASS?	Get the Max pass band width	
CALC[1 2]:FILT:LMAX:BW:ATTE <num></num>	Set the Max stop band width	
CALC[1 2]:FILT:LMAX:BW:ATTE?	Get the Max bandwidth	
CALC[1 2]:FILT:LMAX:INST:LOSS <num></num>	Set the Max insert loss	
CALC[1 2]:FILT:LMAX:INST:LOSS?	Get the Max insert loss	
CALC[1 2]:FILT:LMAX:RIPP <num></num>	Set the Max ripple of pass band	
CALC[1 2]:FILT:LMAX:RIPP?	Get the Max ripple of pass band	
CALC[1 2]:FILT:LMAX:AMPL1 <num></num>	Set the max. level of limit line 1	
CALC[1 2]:FILT:LMAX:AMPL1?	Get the max. level of limit line 1	
CALC[1 2]:FILT:LMAX:AMPL2 <num></num>	Set the max. level of limit line 2	
CALC[1]2]-EILT-LMAY-AMDL22	Get the max level of limit line 2	

CALC[1 2]:FILT:LMIN:FREQ:CENT <num></num>	Set the center frequency of Min
	limit line for filter analysis
CALC[1 2]:FILT:LMIN:FREQ:CENT?	Get the center frequency of Min
	limit line for filter analysis
CALC[1 2]:FILT:LMIN:BW:PASS <num></num>	Set the Min pass band width
CALC[1 2]:FILT:LMIN:BW:PASS?	Get the Min pass band width
CALC[1 2]:FILT:LMIN:BW:ATTE <num></num>	Set the Min stop band width
CALC[1 2]:FILT:LMIN:BW:ATTE?	Get the Min bandwidth
CALC[1 2]:FILT:LMIN:INST:LOSS <num></num>	Set the Min insert loss
CALC[1 2]:FILT:LMIN:INST:LOSS?	Get the Min insert loss
CALC[1 2]:FILT:LMIN:RIPP <num></num>	Set the Min ripple of pass band
CALC[1 2]:FILT:LMIN:RIPP?	Get the Min ripple of pass band

4.3.15. Get the data

Command	Meaning	Input/Output
TRAC? CH[1 2]FDATA	Get the trace data	
TRAC? CH[1 2]FMEM	Get the memory data	

5. Specifications

5.1. TA7100/TA7300 Specifications

Source		
	300KHz \sim 1.8GHz (TA7100)	
Frequency Range	300KHz \sim 3.2GHz (TA7300)	
Frequency Stability	$\leq \pm 5 \times 10^{-6}$	
Frequency Resolution	250Hz	
Phase Noise	≤ -67 dBc/Hz(@10 kHz)	
Output Power	Normal/-5dBm/-10dBm/-15dBm/-20dBm/-25dBm/-30dBm	
Directivity	≥ 50dB (one-port calibration)	
Port Impedance	50Ω(A type), 75Ω(B type)	
Receiver		
Frequency Range	300KHz \sim 1.8GHz (TA7100) 300KHz \sim 3.2GHz (TA7300)	
RBW:	$1 \text{ kHz} \sim 50 \text{ kHz}$	
	≥ 90 dB(TA7100) (RBW = 1 KHz)	
Dynamic Range:	≥ 85 dB(TA7300) (RBW = 1 KHz)	
Max. Input Power	+5 dBm	
Damage Level	+20 dBm, +25VDC	
Port Match:	VSWR ≤ 1.2	
Phase performance		
Phase performance Phase Resolution	0.01 [°]	
Phase performance Phase Resolution Trace Noise Phase	0.01° 0.5° @RBW =	= 1kHz (25°C±5°C,0dBm)
Phase performance Phase Resolution Trace Noise Phase	0.01° 0.5° @RBW = 3	= 1kHz(25℃±5℃, 0dBm) 3kHz (25℃±5℃, 0dBm)
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy	0.01° 0.5° @RBW = 1° @RBW = 3	= 1kHz(25℃±5℃,0dBm) 3kHz (25℃±5℃,0dBm)
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement	0.01° 0.5° @RBW = 3 1° @RBW = 3	= 1kHz (25°C±5°C, 0dBm) 3kHz (25°C±5°C, 0dBm) Reflection Measurement Accuracy
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement ±0.1dB / 1° (+5dB~-20dB)	0.01° 0.5° @RBW = 3 1° @RBW = 3	= 1kHz (25°C±5°C, 0dBm) 3kHz (25°C±5°C, 0dBm) Reflection Measurement Accuracy ±0.4dB / 3° (0dB~-15dB)
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement Accuracy ±0.1dB / 1° (+5dB~-20dB) ±0.2dB / 2° (-20dB~-40dB)	0.01° 0.5° @RBW = 1° @RBW = 3	= $1 \text{kHz} (25^{\circ}\text{C}\pm5^{\circ}\text{C}, 0 \text{dBm})$ $3 \text{kHz} (25^{\circ}\text{C}\pm5^{\circ}\text{C}, 0 \text{dBm})$ Reflection Measurement Accuracy $\pm 0.4 \text{dB} / 3^{\circ} (0 \text{dB} \sim -15 \text{dB})$ $\pm 0.8 \text{dB} / 6^{\circ} (-15 \text{dB} \sim -25 \text{dB})$
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement Accuracy ±0.1dB / 1° (+5dB~-20dB) ±0.2dB / 2° (-20dB~-40dB) ±0.4dB / 4° (-40dB~-60dB)	0.01° 0.5° @RBW = 1° @RBW = 3 ccuracy	= $1 \text{kHz} (25^{\circ}\text{C}\pm5^{\circ}\text{C}, 0 \text{dBm})$ $3 \text{kHz} (25^{\circ}\text{C}\pm5^{\circ}\text{C}, 0 \text{dBm})$ Reflection Measurement Accuracy $\pm 0.4 \text{dB} / 3^{\circ} (0 \text{dB} \sim -15 \text{dB})$ $\pm 0.8 \text{dB} / 6^{\circ} (-15 \text{dB} \sim -25 \text{dB})$ $\pm 2.0 \text{dB} / 15^{\circ} (-25 \text{dB} \sim -35 \text{dB})$
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement ±0.1dB / 1° (+5dB~-20dB) ±0.2dB / 2° ±0.2dB / 2° ±0.4dB / 4° (-40dB~-60dB) Display	0.01° 0.5° @RBW = 3 1° @RBW = 3 ccuracy	= $1 \text{kHz} (25^{\circ}\text{C}\pm5^{\circ}\text{C}, 0 \text{dBm})$ $3 \text{kHz} (25^{\circ}\text{C}\pm5^{\circ}\text{C}, 0 \text{dBm})$ Reflection Measurement Accuracy $\pm 0.4 \text{dB} / 3^{\circ} (0 \text{dB} \sim -15 \text{dB})$ $\pm 0.8 \text{dB} / 6^{\circ} (-15 \text{dB} \sim -25 \text{dB})$ $\pm 2.0 \text{dB} / 15^{\circ} (-25 \text{dB} \sim -35 \text{dB})$
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement Accuracy ±0.1dB / 1° (+5dB~-20dB) ±0.2dB / 2° (-20dB~-40dB) ±0.4dB / 4° (-40dB~-60dB) Display Size	0.01° 0.5° @RBW = 1° @RBW = 3 ccuracy 10.4 inches 1	= 1kHz (25°C±5°C, 0dBm) 3kHz (25°C±5°C, 0dBm) Reflection Measurement Accuracy ±0.4dB / 3° (0dB~-15dB) ±0.8dB / 6° (-15dB~-25dB) ±2.0dB / 15° (-25dB~-35dB) FT color LCD
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement Accuracy ±0.1dB / 1° (+5dB~-20dB) ±0.2dB / 2° (-20dB~-40dB) ±0.4dB / 4° (-40dB~-60dB) Display Size Log Scale	0.01° 0.5° @RBW = 1° @RBW = 3 ccuracy 10.4 inches T 0.01 dB/DIV	= $1 \text{kHz} (25^{\circ}\text{C}\pm5^{\circ}\text{C}, 0\text{dBm})$ $3 \text{kHz} (25^{\circ}\text{C}\pm5^{\circ}\text{C}, 0\text{dBm})$ Reflection Measurement Accuracy $\pm 0.4 \text{dB} / 3^{\circ} (0 \text{dB} \sim -15 \text{dB})$ $\pm 0.8 \text{dB} / 6^{\circ} (-15 \text{dB} \sim -25 \text{dB})$ $\pm 2.0 \text{dB} / 15^{\circ} (-25 \text{dB} \sim -35 \text{dB})$ FT color LCD $\sim 50 \text{ dB/DIV}$
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement Accuracy ±0.1dB / 1° (+5dB~-20dB) ±0.2dB / 2° (-20dB~-40dB) ±0.4dB / 4° (-40dB~-60dB) Display Size Log Scale Linear Scale:	0.01° 0.5° @RBW = 3 1° @RBW = 3 ccuracy 10.4 inches T 0.01 dB/DIV 1μV/DIV ~	= $1 \text{kHz} (25^{\circ}\text{C}\pm5^{\circ}\text{C}, 0 \text{dBm})$ $3 \text{kHz} (25^{\circ}\text{C}\pm5^{\circ}\text{C}, 0 \text{dBm})$ Reflection Measurement Accuracy $\pm 0.4 \text{dB} / 3^{\circ} (0 \text{dB} \sim -15 \text{dB})$ $\pm 0.8 \text{dB} / 6^{\circ} (-15 \text{dB} \sim -25 \text{dB})$ $\pm 2.0 \text{dB} / 15^{\circ} (-25 \text{dB} \sim -35 \text{dB})$ FT color LCD $\sim 50 \text{ dB/DIV}$ 10 V/DIV
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement Accuracy ±0.1dB / 1° (+5dB~-20dB) ±0.2dB / 2° (-20dB~-40dB) ±0.4dB / 4° (-40dB~-60dB) Display Size Log Scale Linear Scale: Resolution	0.01° 0.5° @RBW = 1° @RBW = 3 ccuracy 10.4 inches 1 0.01 dB/DIV 1µV/DIV ~ 0.01 dB	= 1kHz (25°C±5°C, 0dBm) 3kHz (25°C±5°C, 0dBm) Reflection Measurement Accuracy ±0.4dB / 3° (0dB~-15dB) ±0.8dB / 6° (-15dB~-25dB) ±2.0dB / 15° (-25dB~-35dB) FT color LCD ~ 50 dB/DIV 10V/DIV
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement Accuracy ±0.1dB / 1° (+5dB~-20dB) ±0.2dB / 2° (-20dB~-40dB) ±0.4dB / 4° (-40dB~-60dB) Display Size Log Scale Linear Scale: Resolution Sweep time	0.01° 0.5° @RBW = 1° @RBW = 3 ccuracy 10.4 inches T 0.01 dB/DIV 1μV/DIV ~ 0.01 dB About 150m	= 1kHz (25°C±5°C,0dBm) 3kHz (25°C±5°C,0dBm) Reflection Measurement Accuracy ±0.4dB / 3° (0dB \sim -15dB) ±0.8dB / 6° (-15dB \sim -25dB) ±2.0dB / 15° (-25dB \sim -35dB) FT color LCD \sim 50 dB/DIV 10V/DIV s/once \sim 20s/once (201 point)
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement Accuracy ±0.1dB / 1° (+5dB~-20dB) ±0.2dB / 2° (-20dB~-40dB) ±0.4dB / 4° (-40dB~-60dB) Display Size Log Scale Linear Scale: Resolution Sweep time Measurement mode	0.01° 0.5° @RBW = 3 1° @RBW = 3 ccuracy 10.4 inches T 0.01 dB/DIV 1μV/DIV ~ 0.01 dB About 150m	= 1kHz (25°C±5°C, 0dBm) 3kHz (25°C±5°C, 0dBm) Reflection Measurement Accuracy ±0.4dB / 3° (0dB \sim -15dB) ±0.8dB / 6° (-15dB \sim -25dB) ±2.0dB / 15° (-25dB \sim -35dB) FT color LCD \sim 50 dB/DIV 10V/DIV s/once \sim 20s/once (201 point)
Phase performance Phase Resolution Trace Noise Phase Measurement Accuracy Transmission Measurement Accuracy Transmission Measurement Accuracy ±0.1dB / 1° (+5dB~-20dB) ±0.2dB / 2° (-20dB~-40dB) ±0.4dB / 4° (-40dB~-60dB) Display Size Log Scale Linear Scale: Resolution Sweep time Measurement mode Traces	0.01° 0.5° @RBW = 1° @RBW = 3 curacy 10.4 inches 1 0.01 dB/DIV 1µV/DIV ~ 0.01 dB About 150m 2 channels, 4	= 1kHz (25°C±5°C, 0dBm) 3kHz (25°C±5°C, 0dBm) Reflection Measurement Accuracy ±0.4dB / 3° (0dB~-15dB) ±0.8dB / 6° (-15dB~-25dB) ±2.0dB / 15° (-25dB~-35dB) FT color LCD \sim 50 dB/DIV 10V/DIV s/once \sim 20s/once (201 point)
Time domain	LOG Magnitude, Phase, Group delay, VSWR, Smith chart	
-----------------------	--	--
Measurement format	Impedance, Pole chart, Real, Imaginary, Linear Magnitude	
Freq domain	LOG Magnitude, VSWR	
Measurement format		
Storage function	It can storage 2000 state or BMP file, and quickly read/save	
Sweep mode	Linear	
Trigger mode	Continuous, hold, or single	
Ports		
Front panel	N type input, N type output, USB port	
side panel	VGA port	
	standard LAN port	
General information		
Power supply	AC100V \sim 240V/50~60Hz	
Weight	6 Кд	
Operating temperature	Temperature:-10 $^\circ \mathrm{C}~\sim~50 ^\circ \mathrm{C}$, Humidity: ≤75%	
Storage temperature	-40°C ~ 80°C	
Flash Memory	1G bytes	
Size	365 mm × 160 mm × 260 mm	

6. PC Keyboard

Front panel	PC Keyboard
HOME	home
RETURN	0
F1 ~ F8	F1 ~ F8
START	Q
STOP	w
CENTER	E
SPAN	R
SWEEP SETUP	т
TRIGGER	Υ
CH PREV	U
CH NEXT	1
TRACE PREV	К
TRACE NEXT	L
MEAS	А
FORMAT	S
SCALE	D
MARKER	F
MARKER SEARCH	G
PRINT	Н
SYSTEM	J
DISPLAY	Z
AVG	Х
CAL	С
MARKER FCTN	V
ANALYS	В
SAVE RECALL	Ν
PRESET	М
0~9	0~9
+/-	-
G/n	F9
Μ/μ	F10
k/m	F11
x1	F12
ESC	Backspace
ENTER	Enter
UP	Up
DOWN	Down
Knob Counterclockwise	[
Knob Clockwise]

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