![Ceyear]

4992A Radio Test Set

User Manual

China Electronics Technology Instruments Co., Ltd

Preface

Thank you for purchasing and using 4992A Radio Test Set developed and produced by China Electronics Technology Instruments Co., Ltd.

We take meeting your demands as our mission and while offering high quality instruments, we also provide you with technical support and after-sales services. If you have any questions, please don't hesitate to contact us:

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Website	**www.ceyear.com**
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This manual describes the purpose, operation method, precautions, performance characteristics, basic working principle, fault query, etc. of 4992A Radio Test Set developed and produced by China Electronics Technology Instruments Co., Ltd, so as to help you rapidly understand the methods and key points of operation of this instrument. For proper use, please read this manual carefully and properly observe the guidance.

This user manual includes eight chapters in total.

Chapter I provide and overview of 4992A Radio Test Set, including main technical characteristics, existing or available functions and technical indicators.

Chapter II to V mainly describe the operation. Chapter II describes how to handle a new Radio Test Set as well as the precautions during operation. Chapter III mainly introduces the front panel, external interfaces, etc. Chapter IV introduces the basic operations of 4992A. Chapter V introduces the menus of 4992A, which are arranged according to the function categories to facilitate access.

Chapter VI and VII introduce technical requirements, including a brief description of the working principle of 4992A and an introduction to the performance test methods of main technical indicators.

Chapter VIII introduces maintenance requirements, including fault query steps, error information and repair methods.

Due to the limitations in the author's knowledge, there may be errors or omissions in this manual. Your comments are highly appreciated. We apologize for any inconvenience that may rise therefrom.

Editor

January 2018

Verification of Conformity

Certificate No.	:	CTL1803263084-EC
Applicant	:	China Electronics Technology Instruments Co., Ltd
Address	:	NO.98, Xiangjiang Road, Huangdao District, Qingdao, China.
Product	:	Radio Test Set
Trademark	:	思仪 Ceyear
Model(s)	:	4992A, 4992
Manufacturer	:	China Electronics Technology Instruments Co., Ltd
Address	:	NO.98, Xiangjiang Road, Huangdao District, Qingdao, China.
Test Report	:	CTL1803263084-E

Complies with the requirements of the
EC EMC directive 2004/108/EC with amendments.
Test Standards:

EN 61326-1: 2013
EN 61000-3-2: 2014
EN 61000-3-3: 2013

Remarks:

The **CE** markings as shown below can be affixed on the product after preparation of necessary conformity documentation, as stipulated in article 10 of the Council Directive 93/68/EEC.

CE

For Chief Executive
April 04, 2018

Shenzhen CTL Testing Technology Co., Ltd.

Add:Floor 1–A,Baisha Technology Park,No.3011,Shahexi Road,Nanshan District,Shenzhen,China 518055
Tel:(86)0755–89486194　Web:www.ctl–lab.com　E–mail:ctl@ctl–lab.com

Verification of Conformity

Certificate No.	:	CTL1803263084-SC
Applicant	:	China Electronics Technology Instruments Co.,Ltd
Address	:	NO.98, Xiangjiang Road, Huangdao District, Qingdao, China.
Product	:	Radio Test Set
Trademark	:	思仪 Ceyear
Model(s)	:	4992, 4992A
Manufacturer	:	China Electronics Technology Instruments Co.,Ltd
Address	:	NO.98, Xiangjiang Road, Huangdao District, Qingdao, China.
Test Report	:	CTL1803263084-S

Complies with the requirements of the
EC LVD directive 2014/35/EU
Test Standards:

EN 61010-1:2010

Remarks:

Based on the voluntary assessment of the product sample and technical file, we confirm that the above-mentioned product meets the requirements of the EC directive.
The CE mark as show below can be used, under the responsibility of the manufacturer or the importer, after completion of an EC declaration of conformity and compliance with all relevant EC directives.

$C\epsilon$

For Chief Executive
April 28, 2018

Shenzhen CTL Testing Technology Co., Ltd.

Verification of Conformity

Certificate No.	:	CTL1803263084-RC
Applicant	:	China Electronics Technology Instruments Co., Ltd
Address	:	NO.98, Xiangjiang Road, Huangdao District, Qingdao, China.
Product	:	Radio Test Set
Trademark	:	思仪 Ceyear
Model(s)	:	4992A, 4992
Manufacturer	:	China Electronics Technology Instruments Co., Ltd
Address	:	NO.98, Xiangjiang Road, Huangdao District, Qingdao, China.
Test Report	:	CTL1803263084-R

Complies with the requirements of the

EC RoHS Directive 2011/65/EU

Test Standards:

IEC 62321-7-2:2017
IEC 62321-4:2013
IEC 62321-5:2013
IEC 62321-6:2015

Remarks:

Based on the voluntary assessment of the product sample and technical file, we confirm that the above-mentioned product meets the requirements of the EC directive.

The CE mark as show below can be used, under the responsibility of the manufacturer or the importer, after completion of an EC declaration of conformity and compliance with all relevant EC directives.

CE

For Chief Executive
April 04, 2018

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Environment and Safety Instructions

I. Safety Protection

1. Safety precautions for the instrument

1) Use the designated packing box in instrument transportation and avoid damages arising from falling or collision in handling.

2) Use a 220V AC three-core stabilized-voltage power supply to power the adapter, so as to prevent damages to internal hardware arising from high-power peak pulse interference.

3) Ensure the good grounding of power supply as poor or wrong grounding may cause damage to the instrument;

4) Take anti-electrostatic measures in operation, such as anti-electrostatic straps, to prevent electrostatic damage to this instrument.

5) This instrument can be powered by the internal battery. If required, use the battery of the same or recommended type for replacement; otherwise, explosion may occur.

6) The internal temperature is high during operation. In the design, heat is dissipated by the casing. Keep at least 5cm of effective heat dissipation space for the instrument during operation, especially in a cabinet. Ensure sufficient ventilation or use an effective thermal conductor to transmit heat from the casing.

2. Safety precautions for other instrument & equipment

1) Check the working condition and turn off RF output before connecting the instrument, otherwise it may output high power signal to damage the equipment to be tested;

2) The output power may be high in the self-test of this instrument. Please disconnect all external devices.

3) If a fault alarm prompts during operation, indicating that the Radio Test Set is abnormal, please turn off the RF switch or the power supply switch and disconnect all external devices to avoid impacts on the device under test.

3. Personal safety precautions

1) Use appropriate handling tools and place this instrument with care to avoid personal injuries caused by falling of this instrument.

2) Ensure that the power supply is well grounded, as poor or wrong grounding may result in personal injuries.

3) Get the instrument cut off before wiping to prevent electric shock; only wipe the outside of the instrument with dry or slightly wet soft cloth other than the inside.

4) This instrument has potential risks of microwave radiation in the high-power status. Please take corresponding anti-radiation measures.

II. Environmental Protection

1. Disposal of packing container

We are sure that pack container of products is harmless waste, please save packing container and liner for future transportation or dispose them according to local environmental regulations.

2. Treatment of scrapped articles

1) Parts replaced in maintenance and upgrading of this instrument will be recycled by China Electronics Technology Instruments Co., Ltd. The scraped instrument must not be discarded or disposed without permission. Please inform t China Electronics Technology Instruments Co., Ltd or a qualified professional recycling organization for recycling.

2) If required, the internal battery may not be discarded without permission after replacement. It should be separately recycled as chemical waste.

Unless otherwise specified, the above-mentioned operations should abide by *Regulations on Recovery Processing of Waste Electrical and Electronic Products* and local environmental laws and regulations.

CONTENTS

Chapter I Overview

The following safety notes are used throughout this manual. Familiarize yourself with each of the notes and its meaning before operating this instrument.

⚠	**WARNING:**	**WARNING denotes a hazard. It calls attention to a procedure which, if not correctly performed or not adhered to, could result in injury or loss of life.**

⚠	**CAUTION:**	**CAUTION calls out user's special attention. It provides operational information or additional instructions of which the user should be aware.**

☛	**STATEMENT:**	**"STATEMENT" gives instructions or prompts.**

Section 1 Product Overview

1 Brief Introduction

4992A Radio Test Set is equipped with the unified handheld casing, and characterized by high integration, small size, light weight, easy carrying, friendly interface and easy-to-learn operations.

This instrument has the functions of various instruments such as the RF transmitter and receiver analyzer, audio source, audio analyzer. It can be applied to test the overall performance of 2MHz-1000MHz radio transmitters and receivers. With the built-in standing wave ratio test module, a fault of antenna and feeder connection can be rapidly located. The Radio Test Set also has the smallest size and most complete functions in the industry.

This instrument has the high adaptability to the environment and supports the battery use as the power supply. It is not only suitable for production and commissioning of simple laboratory application and communication device, but also applicable to field on-site installation, maintenance support service, etc. It has broad application space in the civilian communication, public security, army informatization, etc.

Fig. 1-1 4992ARadio Test Set

2 Product Features

4992A Radio Test Set is designed with high integration, modularization and standardization to offer excellent performance. Main characteristics are as follows.

◆ Small size, light weight, built-in battery and suitability for field operations.

◆ High environmental adaptability and dust/sand protection capabilities, thus facilitating tests in various environments.

◆ Complete testing capabilities and excellent comprehensive test effects.

◆ Flexible one-key integration/menu customization function to facilitate tests.

◆ Built-in diagnosis module, thus making test effects more intuitive and clearer.

◆ Color touch screen operation interface and effective backlight sensing function.

◆ Friendly human-machine interface and simple operation, thus facilitating the learning and use.

◆ Ethernet and USB interfaces.

3 Functions

This instrument is highly integrated with various test instruments, and wholly has the following characteristics:

◆ Duplex testing function;

◆ RF signal excitation and modulation signal simulation function;

◆ Two-way audio signal generation and audio signal frequency, level, distortion and SINAD analysis function;

◆ RF high-power measurement and signal strength indication function;

◆ RF frequency error measurement function;

◆ RF frequency modulation deviation and amplitude modulation depth testing function;

◆ RF spectrum analysis function;

◆ Audio oscilloscope measurement function;

◆ VSWR testing and cable return loss, cable loss and DTF function;

◆ Radio dialogue testing function.

◆ The digital test software can be upgraded later.

4 Typical application

■Field installation, commissioning and maintenance of radio device

4992A Radio Test Set is highly integrated with various test instruments. On the premise that various functions are realized, the maximum size is 295mm (width)×195mm (height)×70mm (depth), and the weight is less than 2.5kg. This instrument is equipped with the high-capacity rechargeable battery, which can work in a long time after charging. Therefore, this instrument is suitable for field installation, testing and maintenance of radio transmitters/receivers. As the multimeter in the RF measurement field, this instrument will become an essential tool for radio engineers.

■ Performance test of batch production of radios and intercoms

With the popularization of radio communication, military and civilian radios and communication tools will be applied widely. Their development/batch production require various test devices, such as the signal generator, spectrum analyzer, power meter, frequency meter, oscilloscope, audio meter, etc. A complete set of radio/intercom generally includes the transmitter and receiver. To test all performance indicators, various instruments should be switched frequently, which will result in the consumption of a lot of labor, materials and time. 4992A Radio Test Set with integration of various instruments is suitable for full performance tests of various on-board/commercial radios, wireless intercoms, etc. The test process will be simplified, the costs will be reduced, and the work efficiency will be improved. This instrument is equipped with the built-in diagnosis module. The acceptable range can be set for specific test objects. Finally, test data will be outputted in different colors according to the built-in limits, to remind the user of current test results. This function has strong advantages in large-scale production, conventional performance maintenance, etc.

■Antenna/feeder performance maintenance

From the perspective of conventional radio repair, data show that many faults are actually caused by feeder cables and antenna rather than the radio itself. The high return loss arising from cables, connectors or antennas can be expressed as the large VSWR value. Therefore, the test of the standing wave ratio of the feeder cable and antenna is necessary, as the fault can be isolated on the feeder, connector or antenna. With the built-in standing wave ratio test module, 4992A Radio Test Set can be applied to test the standing wave performance of cable ports. Moreover, the fault point can be positioned in the test according to the actual transmission rate of the tested cable. In this case, the return of radios for repair is not required, thus reducing the downtime of the radio system and improving the maintenance efficiency.

Section 2 Main Technical Indicators

1. ## RF source

   This instrument includes double independent RF signal sources, which can be separately selected for independent output. Both sources can be combined inside this instrument for output.

   ➢ Frequency characteristics

   Frequency range: 2MHz-1000MHz (Available to 500 KHZ) (Source 1) (1 GHz option default)

   2MHz～2700MHz (Available to 500 KHZ) (Source 1) (2.7 GHz option)

   2MHz-400MHz (Source 2, ANT port output)

   Frequency resolution: 1Hz

   ➢ Amplitude characteristics

   Output power range:

   1 GHz option: -5dBm to -65dBm (SWR, Source 1)

   -5dBm to -100dBm (ANT, Source 1)

   -50dBm to -125dBm (T/R, Source 1)

   0dBm to -100dBm (ANT, Source 2)

   2.7 GHz option: 5dBm～-65dBm（SWR，Source 1，2MHz～2.2GHz）

   -10dBm～-65dBm（SWR，Source 1，2.2GHz～2.7GHz）

   -5dBm～-100dBm（ANT，Source 1，2MHz～1.8GHz）

   -15dBm～-100dBm（ANT，Source 1，1.8GHz～2.7GHz）

   -50dBm～-120dBm（T/R，Source 1, 2MHz～2.2GHz）

   -55dBm～-125dBm（T/R，Source 1，2.2GHz～2.7GHz）

   -5dBm～-100dBm（ANT，Source 2）

   Power resolution: 0.1dB

   Power accuracy: ±2dB (ANT and T/R port: ≥-100dBm; SWR port: ≥-55dBm)

   ➢ Spectrum purity

   SSB phase noise: ≤-95dBc/Hz@20kHz (1 GHz option default)

   SSB phase noise: ≤-80dBc/Hz@20kHz (2.7 GHz option)

   Parasitic harmonics: ≤-30dBc

   Parasitic non-harmonics: ≤-35dBc (frequency deviation: more than 20kHz) (1 GHz option)

   ≤-30dBc (frequency deviation: more than 20kHz) (2.7 GHz option, 2MHz~2GHz)

   ≤-20dBc (frequency deviation: more than 20kHz) (2.7 GHz option, 2GHz~2.7GHz)

   ➢ Internal AM characteristics(Audio 1 and Audio 2)

   Modulation frequency: 30Hz-5kHz (acceptable setting: 20Hz-20kHz)

   Amplitude range: 0-100%

   Modulation accuracy:± (5% ×modulation depth+2%) (150Hz-5kHz modulation rate, 10%-90% modulation depth)

   Total harmonic distortion: 2% (20%-80% modulation, 1kHz modulation rate, 300Hz~3kHz BP filter)

➢ External AM characteristics
 Microphone input:
   Level range: 20mVrms to 350mVrms
   Frequency range: 300Hz～3kHz
   Amplitude range: 0-80%
 Audioinput:
   Load: 150Ω, 600Ω, 1kΩ, High Z
   Input level: 0.05-3Vp
   Frequency range: 300Hz~5kHz
   Tuning sensitivity: 1%/35mVrms

➢ Internal FM characteristics (Audio 1 and Audio 2)

Modulation frequency: 30Hz to 5kHz (acceptable setting: 20Hz-20kHz)

Frequency deviation range: max. 100kHz

Resolution: 0.01Hz

Accuracy: ±5% (100kHz frequency deviation, 150Hz-5kHz modulation rate)

Total harmonic distortion: 3% (1kHz modulation rate, frequency deviation of more than 2kHz, 300Hz-3kHz BP filter)

➢ External FM characteristics
 Microphone input:

   Level range: 20 mVrms-350mVrms
   Frequency range: 300Hz~3kHz
   Frequency deviation range: max. 80kHz
   Slope: positive frequency deviation corresponding to positive voltage

 Audioinput:
   Load: 150Ω, 600Ω, 1kΩ, High Z
   Input level: 0.05Vp to 3Vp
   Frequency range: 300Hz～5kHz
   Tuning sensitivity:1kHz/35mVrms
   Slope: positive frequency deviation corresponding to positive voltage

2. Audio source (Audio 1and Audio 2)

Frequency range: 20Hz~20kHz
Frequency resolution: 0.1Hz
Frequency accuracy: ±2Hz (standard)
Output level: 20mVrms to 1.57Vrms
Output level resolution: 0.01Vrms
Output level accuracy: ± (5%+5mV)
Output impedance: about 5.62Ω
Output current: <15mA
Harmonic distortion: <3% (1kHz, 1Vrms)
Output: single-tone, dual-tone, noise, single-tone + noise

3. RF meter

RF input port: ANT port and T/R port

Frequency range: 2MHz~1000MHz (1 GHz option default)
    2MHz～2700MHz (2.7 GHz option)

➢ RF power (T/Rport broadband input)

Measurement range: 10-43dBm (0.01W-20W)

    Optional external20dBattenuator (50W, 150W and 200W)

Maximum input level: 20W/43dBm at +25℃ for 10min, or until the overheating alarm is sent.

    The ON and OFF state of the tested signal can be switched.

Resolution: 0.01W/0.1dBm

Accuracy: ±1dB (20-43dBm)

➢ RFfrequency error

ApplicableRF level range:

T/R port: -20dBm to +43dBm

ANT port: -80dBm to -10dBm

Capture range: ±200kHz

Resolution: 1Hz

Accuracy: ±2Hz (time-based)

➢ Received signal strength (RF power within the IF bandwidth of receiver)

Display range:

dBm: -120 dBm - +43 dBm

W: 10pW to 20W

ApplicableRF level range:

T/R port: -50dBm to +43dBm

ANT port (Receiver reference level>-70dBm): -90dBm ~ -10dBm(2MHz~1GHz)

ANT port (Receiver reference level>-70dBm): -80dBm ~ -10dBm(1GHz~2.7GHz)

ANT port (Receiver reference level ≤ -70dBm): -110dBm ~ -10dBm(2MHz~1GHz)

ANT port(Receiver reference level≤-70dBm): -100dBm~-10dBm(1GHz~2.7GHz)

Resolution: 0.01dBm

Accuracy: ±3dB

4. Demodulation meter

RF input port: ANT port and T/R port

Frequency range: 2MHz~1000MHz(1 GHz option default)

2MHz～2700MHz (2.7 GHz option)

➢ AM/FM demodulation configuration

ApplicableRF level range:

T/R port: -20dBm to +43dBm (FM)

-20dBm to +37dBm (AM)

ANT port: -80dBm to -10dBm

IF bandwidth:

5kHz, 6.25kHz, 8.33kHz, 10kHz, 12.5kHz, 25kHz, 30kHz, 100kHz, 300kHz and 600kHz

Audio filter bandwidth:

0.3-20kBP, 0.3-5kBP, 0.3-3kBP, 0.3kHP, 15kLP, 5kLP, 3kLP and 0.3kLP

Audio output level sensitivity:

FM: (3Vrms/kHz Dev)/IF BW (kHz)±15%

AM: 7mVrms/% AM±15%

➢ AM modulation depth

Range: 5% to 100%

Resolution: 1%

Accuracy: ±5%, 1kHz modulation rate, 30%-90% modulation, 3kHz LPF

➢ FM frequency deviation

Range: 500Hz to 100kHz

Resolution: 1Hz

Accuracy: ±10%, with the frequency deviation of 500Hz to 100kHz

±5%, with the frequency deviation of 1kHz to 10kHz and modulation rate of 150Hz to 1kHz

5. Spectrum analyzer (optional)

RF input port: ANT port and T/R port

Frequency range: 2MHz~1000MHz (1 GHz option default)

2MHz～2700MHz (2.7 GHz option)

Sweep bandwidth: 10kHz ~ 998MHz (1 GHz option default)

10kHz ~ 2698MHz (2.7 GHz option)

Reference level range: -80dBm to +50dBm

Vertical ruler: 2, 5, 10, 15 and 20dB/interval

Resolution bandwidth: 10Hz to 30kHz (Step 1, 3 and 10)

In-band frequency deviation range: 0 to ±2.5MHz (frequency: ≥10MHz)

0 to ±500kHz (frequency: <10MHz)

In-band power display range: -137dBm to +43dBm

Amplitude accuracy:

±3dB (T/R input: >-50dBm; ANT input: >-110dBm)

Average noise level display:

1 GHz option:

-110dBm (bandwidth: 10kHz; reference level of receiver: >-70dBm)

-130dBm (bandwidth: 10kHz; reference level of receiver: ≤-70dBm)

2.7 GHz option:

-110dBm (bandwidth: 10kHz; reference level of receiver: >-70dBm) (2MHz~2GHz)

-130dBm (bandwidth: 10kHz; reference level of receiver: ≤-70dBm) (2MHz~2GHz)

-100dBm (bandwidth: 10kHz; reference level of receiver: >-70dBm) (2GHz~2.7GHz)

-120dBm (bandwidth: 10kHz; reference level of receiver: ≤70dBm) (2GHz~2.7GHz)

Residual response:

≤-70dBm (reference level of receiver: >-70dBm) (2MHz~1GHz)

≤-60dBm (reference level of receiver: >-70dBm) (1GHz~2.7GHz)

≤-80dBm (reference level of receiver: ≤-70dBm) (2MHz~1GHz)

≤-70dBm (reference level of receiver: ≤-70dBm) (1GHz~2.7GHz)

6. Audio meter

Input interface: audio input

Frequency range: 20Hz～20kHz

Level range: divided into the following two ranges within 20mVp to 30Vp:

0.01V to 3V (×1)

1V to 30V (÷10)

Impedance matching: 150Ω, 600Ω, 1kΩ and high impedance (60kΩ)

➢ Audio frequency

Resolution: 0.1Hz

Precision: ±1Hz

➢ Audio voltage

Display unit: V, mV, dBuV, dBm and W

Display resolution: 1, 0.1, 0.01 and 0.001

Accuracy: $\pm$ (5% $\times$of measured value+5mV) (high impedance,$\times$ 1-gear)

➤ Distortion (THD)

Audio frequency: 1kHz

Display range: 0 to 100%

Resolution: 0.1%

Accuracy: $\pm$ (5%$\times$ of measured value+0.1%), 1% to 20%.

➤ SINAD

Audio frequency: 1kHz

Display range: 0 to 40dB

Resolution: 0.1dB

Accuracy: $\pm$1.5dB, 8-35dB

7. Digital Voltmeter

Input interface: DVM input

Frequency range: DC-20MHz

Level range: divided into the following two ranges within 100mVp to 60Vp:

      0.1V to 3V ($\times$1)

      2V to 60V ($\div$20)

Impedance matching: 1MΩ

Measurement mode: AC and DC

Display of measurement result: effective value, position peak value and average value.

Display unit: V and mV

Display resolution: 1, 0.1, 0.01 and 0.001

Accuracy: $\pm$10% ($\times$1-gear)

8. Oscilloscope (optional)

Audioinput:

Frequency range: 20Hz$\sim$20kHz

Level range: divided into the following two ranges within 20mVp to 30Vp:

      0.01V to 3V ($\times$1)

      1V to 30V ($\div$10)

Impedance matching: 150Ω, 600Ω, 1kΩ and high impedance (60kΩ)

DVM input:

Frequency range: DC-20MHz

Level range: divided into the following two ranges within 100mVp to 60Vp:

      0.1V to 3V ($\times$1)

      2V to 60V ($\div$20)

Impedance matching: 1MΩ

Demodulation signal: the internal demodulation signal can be measured when the receiver is opened.

Scanning line: 1

Cursor: 2

Trigger:

    Mode: auto, standard and single

    Pulse edge: rising edge and falling edge

    Trigger level setting:

-3V to +3V (if the range setting reaches 3V)

-30V to +30V (if the range setting reaches 30V)

-60V to +60V (if the range setting reaches 60V)

Horizontal:

Range: 0.2ms per interval to 50ms per interval, according to the sequence 1/2/5

Accuracy: ±3%, within the full range

Vertical:

Range: FM demodulation: vertical scale of 100Hz to 1kHz per interval, according to the sequence 1/2/5

AM demodulation: vertical scale of 5%, 10%, 20% or 50% per interval

DVM and audio input: vertical scale of 10mV to 20V per interval, according to the sequence 1/2/5

Accuracy: ±10% (×1 level for external input audio/DVM signal)

Coupling:

Audio input: AC

DVM input: AC, DC

Input impedance:

DVM input: 1MΩ

Audio input: 150Ω, 600Ω, 1kΩ, High Z

Band width: 20kHz

9. Cable test

Frequency range: 2MHz～1000MHz

Frequency resolution: 0.1MHz

Cursor: 3

Test type: standing wave ratio (SWR), return loss (RL), cable loss (LOSS) and distance-to-fault (DTF).

VSWR measurement accuracy (using 25Ω air line as the calibration device): SWR reading ±10% (calibration value) in the case of no more than 500MHz

SWR reading ±20% (calibration value) in the case of more than 500MHz

DTF measurement range: 1m to 100m

Resolution: 0.01m

Rate: 0.00 to 1.00, automatically selected according to the cable type or manually entered by the user

Measurement accuracy: ±10%

10. Internal time base

Aging rate: $<1\times10^{-6}$/year;

Temperature stability: 1×10^{-6} (with 25℃ as the reference temperature)

Frequency accuracy: ±2ppm (25℃)

⚠ !	**CAUTION:**	**4992A Radio Test Set will meet various performance indicators within the given working temperature after 2h storage at the ambient temperature and 15min preheating.**
		Supplementary features in the form of typical value are

only for reference but not assessment.

11. Input/Output port

Table 1-1 Input/Output Port

Name	Identification	Interface type
RF input/output port	ANT	BNC interface
	T/R	BNC interface
RF output port	SWR	BNC interface
Audio output port	Audio Out	BNC interface
Audio/DVM input port	Audio In/DVM	BNC interface
GPS signal input port	GPS	BNC interface
Audio box interface	Audio set	Special 10-core connector

Article I Handling Instructions

Chapter II Operation Guide

Section 1 Unpacking Inspection

1 Model confirmation

You can see one packing list and the following articles after unpacking:

a)4992A Radio Test Set;	1 set
b) Power adapter;	1 piece
c) Standard three-phase power cord;	1 pcs
d) User Manual;	1
e) Accompanying CD;	1
f)USB cable;	1 pcs
g) Built-in rechargeable lithium ion battery;	1
h) Optional parts (according to the order information);	Several
i) Product certificate.	1

Please check the articles above according to the order contract and container loading list. If you have any questions. Please contact us in line with the contact information in Preface or contact the business center of China Electronics Technology Instruments Co., Ltd, we'll tackle problems as soon as possible.

/!\ **CAUTION:** **The instrument is a kind of valuable device and should be handled with care.**

2 Appearance inspection

Carefully check whether the instrument is damaged in transportation. If the instrument is damaged obviously, do not connect the power supply! Contact our business center according to the above contact information. We will rapidly repair or replace the instrument, depending on the situation.

Section 2 Safety Instructions

The safety of 4992A Radio Test Set conforms to the requirements of GJB3947A-2009. The instrument is not equipped with any part that can be operated by the user. Do not open the instrument casing without permission; otherwise, personal injuries may be caused. In order to ensure the personal safety and proper operation, carefully read the following safety precautions prior to use.

1 Environmental requirements

In order to ensure the service life of 4992A and the effectiveness and accuracy of measurement, tests should be done under the following conditions.

∎Temperature range:

Storage temperature range: -40℃ to +70℃

Operating temperature range: -10℃ to +50℃

⚠ **WARNING:**	As the battery storage temperature range is -20℃ to 60℃, the battery must not work continuously in a long time at high temperature, so as to avoid risks arising from high temperature. It is recommended to use the adapter to supply power.

■ Low air pressure:

Low air pressure (altitude): 0-4600m

2 Selection of power line

4992A Radio Test Set is provided with the three-core power cord that conforms to international safety standards. The power cord should be inserted into the appropriate power socket with the protective grounding wire, so that the casing of this instrument can be grounded. It is recommended to use the accompanying power cord and replace it with the same type of 250V/10A power cord.

3. Power supply requirements

4992A can be powered up in three methods:

■ AC power supply and power supply with adapter

If the AC power supply is applied, use the accompanying AC-DC adapter. The input of the adapter should be 100-240V and 50/60Hz AC power.

If the instrument is transported and carried in the bag, the AC-DC adapter must not be connected to the instrument so as to prevent the instrument from overheating. The AC-DC adapter has a broad range of voltage input. Ensure that the power supply voltage meets the requirements of Table 2-1 during operation.

Table 2-1 Power Supply Requirements

Power supply parameter	Applicable range
Input voltage	100V ~ 240VAC
Rated input currency	1.7A
Work frequency	50/60Hz

Output Voltage/Current	15.0V/4.0A

⚠ **CAUTION:** The working voltage and frequency ranges are subject to the parameters provided on the nameplate of the power adapter.

■DC power supply

Voltage 12V to 18V (without battery), 15V to 18V (with battery)

Current: 4A (min.)

■Power supply with built-in battery

4992A can be powered up with the rechargeable lithium ion battery. The battery will be subject to discharge if not used in a long time. Therefore, it must be charged before use. See battery operation details in Section 2.6. Basic parameters of the accompanying battery are as follows.

Nominal voltage: 10.8V

Nominal capacity: ≥7000mAh

⚠ **CAUTION:**

The rechargeable battery must not be exposed to fire or high-temperature environments (above 70℃), or placed in fresh water or salt water, or made wet. It must be kept away from children.

The rechargeable battery can be used repeatedly. It should be kept in an appropriate container to prevent short-circuiting. Heavy metals such as nickel and chromium may result in pollution to the natural environment. The scraped or old battery must not be discarded without casually. Instead, it should be placed into the special battery recycling box.

4. Electrostatic protection (ESD)

Static electricity is destructive to electronic components and devices. Therefore, this instrument must be powered up on the anti-electrostatic table. Pay attention to electrostatic protection in operation of this instrument. If possible, take the following electrostatic protection measures.

a) All instruments must be properly grounded to prevent static electricity.

b) The staff must wear anti-static wrist straps before contact with connectors or core wires or any assembly.

c) The central conductor of the cable must be grounded before the cable is connected to the instrument for tests. This can be realized according to the following steps: connect the short-circuiting device to one end of the cable to short-circuit the central conductor of the cable and the external conductor, wear the anti-static wrist strap, hold the casing of the cable connector, connect the other end of the cable, and remove the short-circuiting device.

5. Input/output port protection

The Radio Test Set is equipped with multiple RF/audio and other input/output ports. The standard impedance of the RF port is 50Ω, the matching impedance of the audio input port is optional, and the audio output port is limited by the current. Therefore, the test signal or appropriate load impedance must be applied in strict accordance with the port requirements to prevent the circuits at subsequent levels from damage.

WARNING: Each RF/audio input port of the Radio Test Set should meet the maximum allowable input level requirements. The applied signal must conform to the limit requirements; otherwise, the instrument will be damaged.

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6. Cleaning of display of front panel

If required after operation of certain time, the display panel of the instrument can be cleaned according to the following steps.

a) Shut down the instrument and disconnect the power line.

b) Wipe display panel with clean and soft cotton cloth with detergent.

c) Dry display panel with clean and soft cotton cloth.

d) Do not connect power line until detergent dries out.

CAUTION: There is an anti-static coating on the surface of the display screen. So never use cleaning agent including fluoride, acid or alkaline substance and do not directly spray the agent to the display panel, or the agent may enter the monitor and further cause damage to the device.

Section 3 Battery Installation and Replacement

1. Battery description

4992A Radio Test Set is equipped with one high-capacity rechargeable lithium ion battery.

The battery life is 4h generally. In order to ensure the battery life, the battery should be taken out of the battery compartment before transportation and long-time storage. In order to facilitate the long-time field test and prevent the test interruption arising from insufficient capacity of the battery, the user can purchase the standby battery. It is recommended to purchase the battery of the same model as the accompanying battery.

2. Battery installation and replacement

The battery of 4992A Radio Test Set can be easily installed or replaced. The user can install or replace it according to the following diagram.

Push down the battery cover

Remove the battery cover

Insert/pull out the battery

Push up the battery cover

Install the battery cover
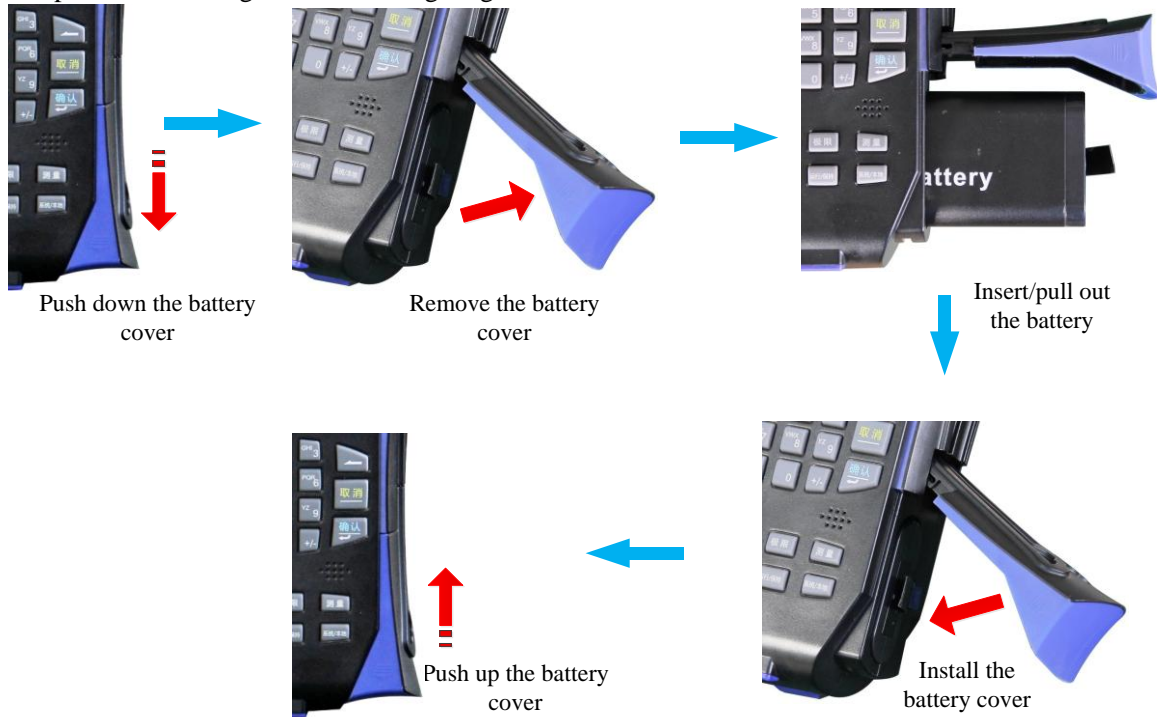
Fig. 2-1 Steps of Battery Installation and Replacement

3. Battery status check

4992A Radio Test Set is provided with one battery. The user can check the battery status in one of the following methods.

■ Observe the battery icon on the system status bar to roughly know the battery capacity. If only one grid exists in the battery icon, replace or charge the battery promptly.

■ Take out the battery. Press the button at the white point of the battery end. Then the indicators above the button will be ON, indicating the remaining electricity quantity. If only one indicator is ON, charge the battery promptly.

4. Battery charging

The battery can be charged in the shutdown or operation status of 4992A Radio Test Set. Charging steps are as follows:

■ First place the battery to be changed into the instrument.

■ Connect the external power supply with the accompanying AC-DC adapter.

■ If charging is done in the shutdown status, the LED indicator in the lower left corner of the front panel will flicker in yellow, indicating that the battery is being charged. After

charging, this indicator will be normally ON in yellow. If charging is done in the operation status, the LED indicator will flicker in green, indicating that the battery is being charged. After charging, the indicator will be normally ON in green. In this case, the battery icon on the right side of the system status bar of the touch screen will be full.

In addition, the run-out battery should be charged for about 4h in the shutdown status.

5. Battery life

The battery charge and discharge are limited. Considering the power consumption of the instrument and the general probability of use, the estimated battery life is about two years. It is recommended to promptly replace the acceptable battery of the same model after expiration of the battery life, so as to prevent risks or failure to achieve the expected effects.

Section 4 User Inspection

Notes:	**Description form of hard key and soft key input in front panel as below:** **a) Description form of hard key: [XXX], XXX is name of hard key** **b) Description form of soft key: [XXX], XXX is name of soft key** **For soft keys that have two statuses, the options with deeper background color are available.** **For example, [RF output ON OFF] indicates that the RF output "ON" is available.**

1 Preliminary check

Connect the power adapter of 4992A Radio Test Set to the external power supply. In this case, the power indicator on the front panel will be yellow, indicating that the standby power supply is working normally. Carefully press the soft power switch on the front panel for more than 3 seconds. The power indicator on the front panel will become green, and the display backlight will be ON. About 30 seconds is required to wait for display start-up. Then the normal start status interface will appear. There should be no warning prompt on the display interface after 10min warm-up.

Note: "Flicker" of the indicator indicates that the electricity quantity of the internal battery is not full and the battery is being charged.

2 Detailed check

1) Connect the SWR and ANT port with the cable, and the Audio Out and Audio In with the cable.
2) Turn on the instrument for 15min warm-up.
3) Press [Measurement] hard key and open the RF source window by setting the instrument menu. Set the RF source window as follows:

   Output Source: RF Source 1

   Output port: SWR

   Frequency: 100MHz;

   Power: -20 dBm
4) Turn on the RF meter and set it as follows:

   Receiver setting:

   Frequency: 100MHz;

   Port: ANT

   IF bandwidth: 5kHz
5) Open the audio source window, and set it as follows:

   Output source: Audio Source 1

   Output port: audio output

   Frequency: 1kHz;

   Level: 1Vrms
6) Turn on the audio meter and set it as follows:

Impedance: high impedance

7) Requirement of test results: RF frequency error: 0±2Hz

Audio frequency: 1kHz±0.1Hz.

Chapter III Panel Description

Section 1 Description of front panel

The front panel of 4992A Radio Test Set front panel is shown in Fig. 3-1.

Fig. 3-1 Front Panel

1 Display Zone

The instrument is equipped with one 7-inch color touch screen. The setting of parameters and display of a lot of information can be realized by means of touch, thus eliminating the troublesome steps of soft and hard key menu setting and greatly simplifying the operation.

The display zone can display the following information corresponding to various functions of the instrument: multiple instrument windows that include settings and measurement data of this instrument; operating status information; current input data for the input frequency and other parameters; current operating time of the system; and menu information corresponding to the current valid operation window. Details are introduced in Fig. 3-2.
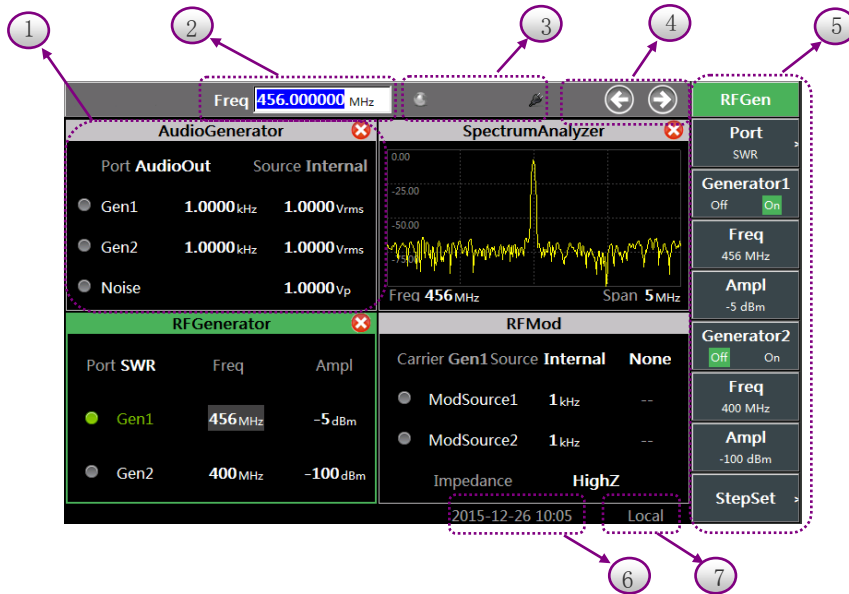
Fig. 3-1 Display Zone

Details of various zones are introduced below.

①Instrument window zone

The opened instrument window is displayed in this zone, including relevant instrument setting or measurement information. The current parameter setting can be changed by clicking the parameter position or in the right soft menu. The window of the multi-screen instrument can be switched or closed, and set in the window management zone.

② Active input zone

The current active parameter setting function is displayed in this zone. For example, if the frequency input parameter needs to be set, the current frequency setting box will be displayed here.

③ Power status/GPS status

The current GPS receiver status of the Radio Test Set, the operating status of the power supply and the real-time prompt of electricity quantity are displayed in this zone.

④ Window management zone

Multiple meters are integrated in this instrument. In order to reasonably utilize the display zone, at most four meter window can be displayed at the same time. If more than four meters are turned on at the same time, the meter interface can be displayed by page turning with the leftward and rightward key. The meter in the current valid window can be shut down with the "Close" key.

⑤ Soft key menu zone

The settable menu or relevant information of the current active window are defined in this zone and can be displayed at various levels. The soft key menu will change according to the selected window and function. If another soft key is pressed, the corresponding font color and background color will change.

⑥ Time display zone

The current time is displayed in this zone. You can set the time by clicking this zone or in the system menu.

⑦ Operation mode zone

The current operation mode of the receiver is displayed in this zone. Two modes are optional:

"Local" and "Program Control". If the receiver is in the "Program Control" status, the local mode can be recovered by pressing the [System] hard key.

2. Number input zone

The number input zone includes direction keys, knob, ←/− (backspace/minus) and number keys. All the input contents can be changed with the keys and knob in this zone. The keys of this zone are introduced below.

a) **Direction keys:** the UP and DOWN key are applied to increase or decrease the value. The leftward and rightward key are not provided here. The step value of the UP and DOWN key is set according to the step of each parameter.

b) **Knob:** increase or decrease the value. If the knob is rotated clockwise, the variable will increase; otherwise, the variable will decrease. The knob can be applied with the UP and DOWN key to change the value. The step of the knob is the same as that of the UP and DOWN key.

c) **Number keys:** enter the numbers (including the minus).

d) **Backspace:** cancel the last set data bit by bit according to the setting status.

e) **Cancel:** cancel the current data that is set but not valid.

f) **OK:** confirm the current parameter setting.

3 Functional key zone

Functional keys are distributed in two zones. The zone in the lower part of the screen is mainly for general auxiliary functions, and the zone in the lower right part for main function setting.

In the auxiliary function zone, you can press [System] to switch the program control mode into the local mode and the right menu to set the GPS positioning, lock button, date, etc. The device information and message record are displayed. [File] is applied to save or call the setting status of the instrument; [Window] is applied to switch the current active meter window; [Menu] is applied to change into the right soft menu, where you can press OK to select the corresponding soft key function; and "Full Screen" is applied to maximize or recover the current active window.

In the main function setting zone, [Measurement] is applied to enter the main menu of top level. You can directly select to open multiple test meters by window setting. [Transmitter] is applied to directly open the RF receiver test meters without entering the main menu of top level, including the audio source, RF meter, demodulation meter, receiver setting, etc. [Receiver] is applied to directly open internal RF source meters without entering the main menu of top level, including the RF source, modulation source, audio meter, etc. [Cable] is applied to directly open the cable test window without entering the main menu of top level. [Call] is applied to directly call the test meters with the audio box port, including the RF source, modulation source, demodulation meter, receiver setting, etc. [Audio] is applied to directly opened the audio source and audio meter window without entering the main menu of top level.

4 Reset button

Press [Reset] to shut down the instrument and power up it again.

5 Power switch

It is applied to turn on and off the Radio Test Set. If the external power supply with adapter is applied, the yellow indicator near the power switch will be ON in the "Standby" status of the instrument. If the power switch is pressed for more than 3 second, the indicator will be come green, indicating that the instrument is in the "operating" status. In this case, you can press the

power switch for more than 3 seconds to turn off the Radio Test Set.

Note: "Flicker" of the indicator indicates that the electricity quantity of the battery is not full at present and the battery is being charged.

Section 2 Interface Description
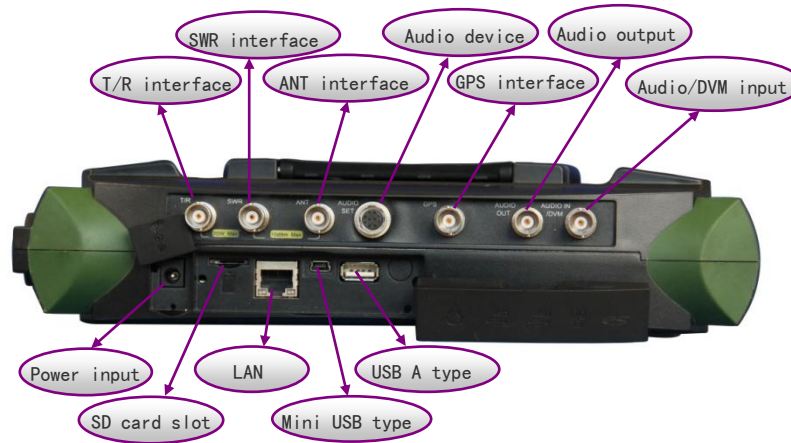
Fig. 3-3 Interface Description

1. T/R interface

This is an RF signal interface and can be applied to send the signal of the internal RF Source 1 or as the receiver input end to receive RF signals to be tested. The sensitivity of this port is low. Note that the input signal must pass through this port in the broadband RF high power test.

2. ANT interface

This port is an RF signal interface and can be applied to the signal of the internal RF Source 1 or 2 or the combined signal, or receive the RF signal to be tested. It has high sensitivity. Generally, it is connected to the tested radio system for radio test or connected to the antenna input test signal.

3. SWR interface

This port is an RF signal output interface, and can be applied to send the signal of the internal RF Source 1, or test the standing wave ratio, insertion loss, return loss and other indicators of the cable by comparison of output and reflected signals so as to determine the distance-to-fault of the cable.

4. Audio box interface

The multi-core plug of this port includes the audio input and output signal information. This power can be connected to the external audio box or tested audio device for calling or testing of the external audio device.

5. GPS interface

This port is connected to the GPS antenna to determine the current location of the tester.

6. AUDIO OUT interface

This port is applied to output the separate signal of the Audio Source 1, Audio Source 2 or noise source, or output the combination of any two signals.

7. AUDIO IN/DVM interface

This port is applied as the external audio input or digital voltmeter test signal input end.

8. Power input

This is used for external DC power input. The DC output of the AC-DC adapter or the DC power supply is applied to supply power to the tester. The inner conductor of the external power supply interface is used as the anode, and the outer conductor is grounded.

9. SD card slot

The Micro SD card can be applied to expand the instrument memory, or copy relevant data and files in the instrument.

10. LANinterface

This instrument is equipped with one 10/100Mbps LAN interface of standard 8-pin structure. Two data rates can be selected automatically. This interface can be connected to PC via the network line to realize the program control and data transmission of 4992A Radio Test Set.

11. Mini USB interface

It is connected to the external computer (PC). Relevant tool software can be run in the computer for program control and data transmission of 4992A Radio Test Set.

12. USB A interface

It is connected with USB peripherals, such as the USB memory, USB mouse, USB keyboard, etc.

Chapter IV Operation Guidance

This chapter introduces the basic operations of 4992A Radio Test Set. The operation process of this instrument is introduced in details below according to the functions.

| ⚠️ ! | **CAUTION:** | If [Reset] on the front panel is pressed, the instrument will be run again. In the following examples, unless otherwise specified, all the operations are started by pressing [Reset]. |

Section 1Operation Guidance for RF Transmitter Function

This part describes some operations of 4992A Radio Test Set for RF signal generation and measurement.

4992A Radio Test Set is equipped with two independently controlled signal sources. One signal source can be selected for independent output or both sources can be combined in the instrument for output. RF Source 1 can be loaded with modulation waves of two types: AM and FM, for modulation output of double audio sources.

1.RF Source 1

The T/R, SWR and ANT port can be applied for output of the RF Source 1 of 4992A. The appropriate output port can be selected according to various power requirements.

➢ Open the window: open and select the RF source window by pressing [Receiver] or pressing [Measurement] and setting the instrument menu. Press [Full Screen] in the lower part of the screen to maximize the window, as shown in Fig. 4-1.

Fig. 4-1 RF Source Display Window

➢ Call the menu: click the touch screen, select the RF source window as the current active window, and the corresponding menu will pop up on the right of the window, as shown in Fig. 4-1.

➢ Set the output port of Source 1: click "Port" in the window, and select the output port in the drop-down menu, or click [Output Port] in the right menu of the touch screen and select the output port.

➢ Set the frequency of Source 1: click the corresponding frequency of RF Source 1 in the window, and set the output frequency of Source 1, or click the [Frequency] soft key in the right menu, and set the output frequency of Source 1 with number keys. The setting range of the output frequency of RF Source 1 is 2MHz to 1000MHz.

➢ Set the power of Source 1: click the corresponding power of RF Source 1 in the window, and set the output power of Source 1 with number keys, or click the [Power] soft key in the right menu and set the output power of Source 1 with number keys. Note that the output power of various ports is different from each other.

➢ RF Source 1 ON/OFF: click "RF Source 1" in the window to control the ON/OFF state of

RF Source 1, or click [RF Source 1] in the right menu to control the ON/OFF state of RF Source 1. If RF Source 1 is ON, the font in the window will be displayed in green, and the current status of RF Source 1 will be displayed in the [RF Source 1OFF ON] soft key of the right menu.

➢ Set the step: click the [Frequency step] soft key of the right menu of the window to enter the menu of next level, and set the frequency step and amplitude step. After step setting, select the output frequency or output power. If the knob is rotated or [↑] or [↓] is pressed, the current frequency or power will change according to the set step value.

2. Modulation source

➢ Open the window: open and select the RF source window by pressing the [Receiver] hard key or pressing the [Measurement] hard key and setting the instrument menu. When the RF source window is opened, the modulation source will be opened accordingly. The operation window is shown in Fig. 4-2.
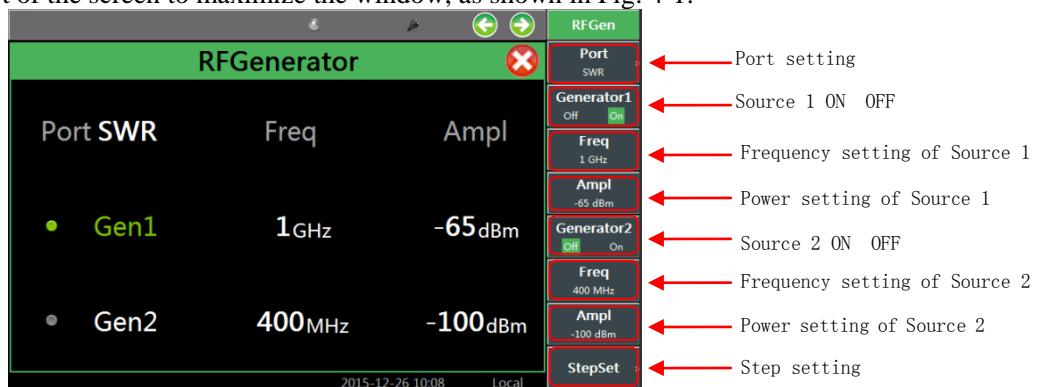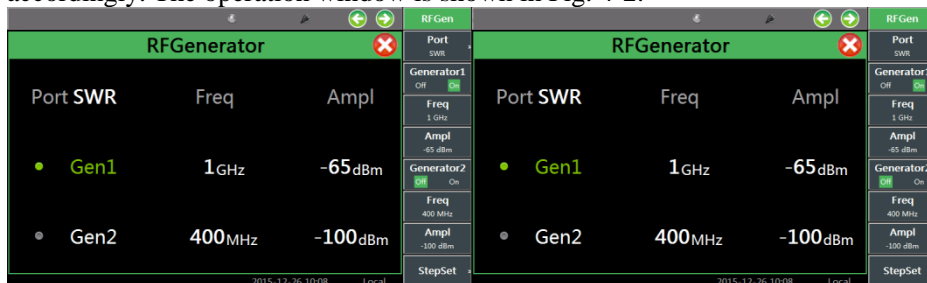

Fig. 4-2 RF Source and Modulation Source Window

➢ Call the menu: click the touch screen, select the modulation source window as the current active window, and the modulation source window menu will be displayed in the right side of the window.

➢ Set the carrier parameter: refer to the requirements of "RF Source 1". Note that the modulation wave must be loaded by RF Source 1.

➢ Set the modulation source: click "Modulation Source" in the window and select the type of the modulation source, or press the [Modulation Source] soft key in the right menu of the window and select the type of the modulation source. The modulation source is divided into three types: internal audio, external audio and external MIC.

➢ Set the modulation type: the default modulation type is "No Modulation". You can select the modulation type by clicking "No Modulation" in the window and selecting the modulation type in the drop-down menu or clicking the [Amplitude Modulation AM] or [Frequency Modulation FM] soft key in the right menu of the window and selecting the modulation type. Note that the modulation type and modulation rate are only for the internal audio signal. For the external audio signal, the above parameters should be set in the external modulation source.

➢ External audio modulation: for the external audio signal, click the corresponding impedance on the right side of "External Audio Input" in the window, and select the external audio impedance in the drop-down menu, or click the [External Audio Impedance] soft key on the right side of the window to enter the menu of next level and select the required impedance value. Note that the [External Audio Impedance] soft key

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in the right side of the window is available only when "External Audio" is selected.

➢ Internal audio modulation: for the internal audio signal, directly click the corresponding parameters in the window, or click the [Internal Audio Setting] in the right menu of the window to enter the menu of next level to set the internal audio modulation. As shown in Fig. 4-2, the modulation source is "Internal Audio", the modulation type is "AM", and the modulation depth is "30%".

➢ External MIC modulation: for the external MIC signal, the audio signal collected by MIC in the audio box is used as the modulation input. The modulated output can be realized after the modulation type is selected.

3.RF Source 2

RF Source 2 of 4992A is only for the output of ANT port.

➢ Open the window: open and select the RF source window by pressing [Receiver] or pressing [Measurement] and setting the instrument menu. Press [Full Screen] in the lower part of the screen to maximize the window, as shown in Fig. 4-3.
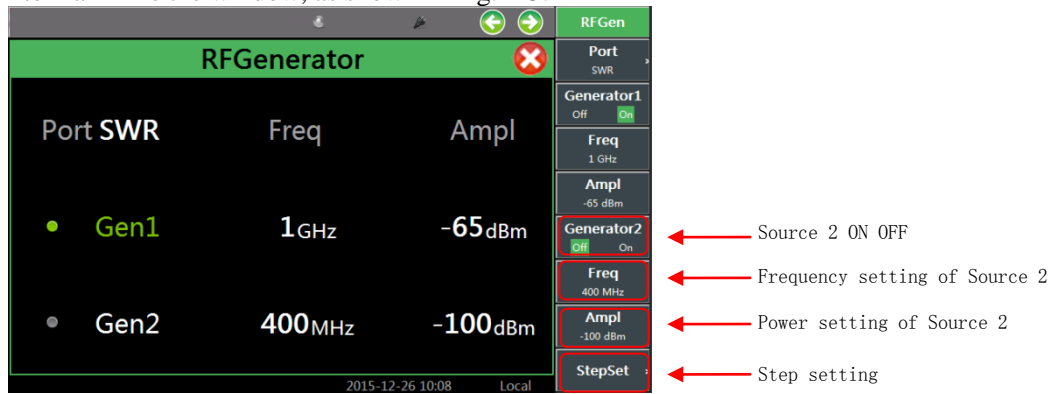
Fig. 4-3 Display Window of RF Source 2

➢ Call the menu: click the touch screen, select the window of Source 2 as the current active window, and the corresponding menu will pop up in the right side of the window, as shown in Fig. 4-3.

➢ Set the output port of Source 2: only the ANT port is for output of RF Source 2. If RF Source 2 is ON, ANT will be automatically selected as the output port.

➢ Set the frequency of Source 2: click the corresponding frequency of RF Source 2 in the window, and set the output frequency of Source 2, or click the [Frequency] soft key in the right menu, and set the output frequency of Source 2 with number keys. The setting range of the output frequency of RF Source 2 is 2MHz to 400MHz.

➢ Set the power of Source 2: click the corresponding power of RF Source 2 in the window, and set the output power of Source 2 with number keys, or click the [Power] soft key in the right menu and set the output power of Source 2 with number keys. The setting range of the output power of RF Source 2 is -100dBm to 0dBm.

➢ RF Source 2 ON/OFF: click "RF Source 2" in the window to control the ON/OFF state of RF Source 2, or click [RF Source 2] in the right menu to control the ON/OFF state of RF Source 2. If RF Source 2 is ON, the font in the window will be displayed in green, and the current status of RF Source 2 will be displayed in the [RF Source 2 OFF ON] soft key of the right

menu.

➢ Set the step: click the [Frequency step] soft key of the right menu of the window to enter the menu of next level, and set the frequency step and amplitude step. After step setting, select the output frequency or output power. If the knob is rotated or [↑] or [↓] is pressed, the current frequency or power will change according to the set step value.

⚠ **CAUTION:** We are sorry that 4992A Radio Test Set includes the 50MHz clock signal, and due to the size limitation, the influence on the output channel of the RF source cannot be completely eliminated and the above signal is the main source of stray signal of the instrument. In addition to the influence on Source 1, the channel of Source 2 will be affected if Source 1 and 2 are opened at the same time, although the radiation can meet the stray indicator requirements. If the frequency signal that is not the integer times of 50MHz is outputted by Source 1 and the set power is 0dBm, the typical value of the measured stray signal of 50MHz or its integer times will be less than -70dBc. Therefore, special attention should be paid to the frequency signal that is vulnerable to interference.

Section 2 Operation Guidance for RF Receiver Function

This part describes some operations of 4992A Radio Test Set for RF signal reception and measurement.

1.RF power

The RF power measurement of 4992A is designed for the RF T/R port only, and the broadband signal power of RF 20-43dBm can be measured.

➢ Window opening: open the RF meter window by pressing the [Measurement] hard key and setting the instrument menu, and click the RF power in the touch screen, or click the [RF Power] soft key in the right side to enable the RF power function. Press the [Full Screen] hard key in the lower part of the screen to maximize the window, as shown in Fig. 4-4.

Fig. 4-4RF Power Measurement Window

➢ Menu calling: open and select the RF meter window, and the corresponding menu will be displayed in the right side of the window, as shown in Fig. 4-4.
➢ Display of measurement results:
  ● Unit selection: click the [RF Power Unit] soft key in the right side of the touch screen and select the output unit: dBm, W, μV and dBμV.
  ● Average setting: the real-time broadband power is measured in RF power measurement. Therefore, the averaging of measurement results can be set according to the stability requirements. In particular, when the tested signal is the FM signal of low modulation rate, measurement results will change constantly. In this case, the user can set the averaging of measurement results to stabilize the display effects in the following method: click "Average" in the window or the [Average] soft key in the right side of the touch screen, open "Average", click the [Averaging Times] soft key in the right side of the touch screen, and the measurement result will be displayed after averaging according to the set times.
  ● Setting of compensation frequency of frequency response: the user should enter the frequency according to the current test signal, and the frequency response will be compensated automatically.
➢ Alarm setting: judge whether the measurement result conforms to the requirements. If it is

beyond the range, the alarm color will be displayed to make the judgment more intuitive. Click "Alarm Setting" in the window, or click the [Alarm Setting] soft key in the right menu to open the alarm setting window, and set the upper alarm limit and lower alarm limit. Note that the alarm setting must be within the measurement range between the upper and lower limit.

⚠ **WARNING:**	A lot of heat is generated by the internal attenuator in high power measurement with this port. Note that high power must not be tested continuously in a long time. At +25℃, the power of 20W/43dBm can only be measured for 10 consecutive minutes. In case of overheating alarm, the measurement must be stopped immediately. The ON and OFF status of the tested signal can be switched properly.

2.RF frequency error

The RF meter of 4992A is used for measuring the frequency error between the input signal and the set frequency point. This is designed for the RF ANT and T/R port. The user can select the appropriate port to input the tested signal according to the power of the input signal.

➢ Window opening: open the RF meter window by pressing the [Transmitter] hard key or pressing the [Measurement] hard key and setting the instrument menu. Select the window, and press the [Full Screen] hard key in the lower part of the screen to maximize the window, as shown in Fig. 4-5.

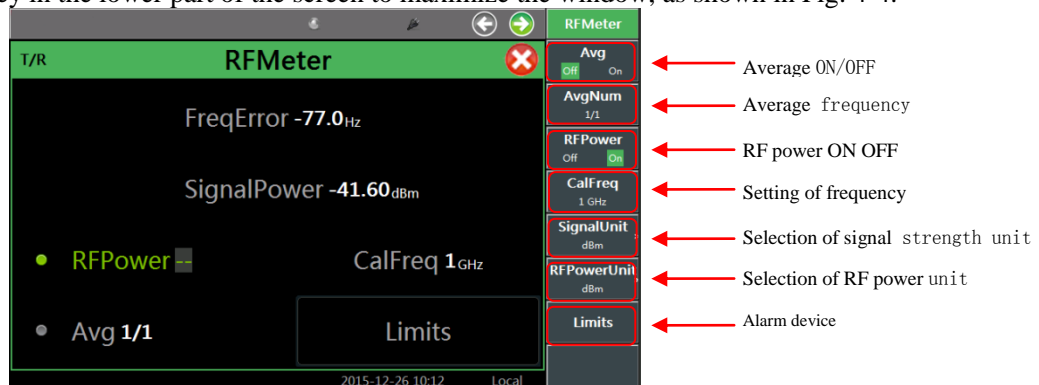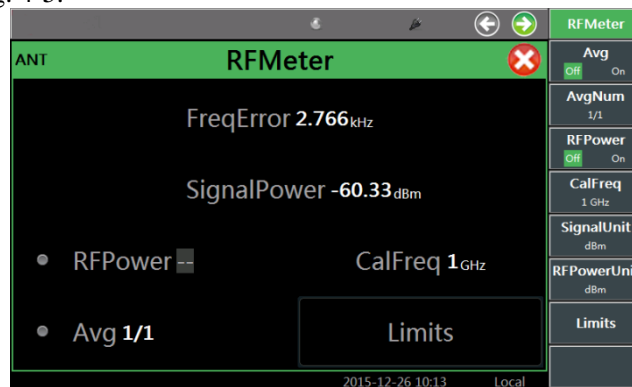Fig. 4-5 Frequency Error Measurement Window

➢ Menu calling: click the touch screen, select the RF meter window as the current active window, and the corresponding menu will be displayed in the right side of the window, as shown in Fig. 4-5.

➢ Receiver setting: when the RF meter window is opened, the receiver setting window will pop up at the same time. Click the interface or right soft key menu, and set the receiver port, frequency, reference level, IF bandwidth, automatic search, etc. The receiver setting window is shown in Fig. 4-6.
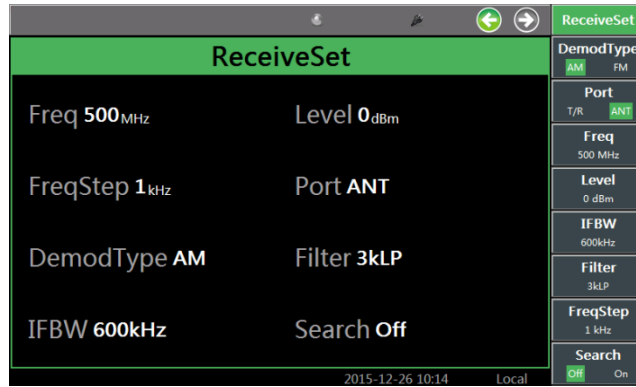
Fig. 4-6 Receiver Setting Window

● Power setting: select the T/R or ANT port under [Input Port] of the [Receiver Setting] menu for input of the tested signal, according to the power of the tested power.

● Frequency setting: set the receiver frequency as the frequency of the tested signal in the [Receiver Setting] menu. The user can set the [Center Frequency Step] and change the frequency with the UP and DOWN key and the knob.

● Reference setting: estimate the level amplitude of the tested signal and set the reference level of the receiver in the [Receiver Setting] menu, thus providing an appropriate gain channel for the input signal.

● IF bandwidth setting: click the [IF Bandwidth] soft key in the right [Receiver Setting] menu. The setting range of the IF bandwidth is 5kHz to 600kHz, divided into 11 levels. Set the IF bandwidth according to the receiver setting. The maximum capture range of the instrument is ±300kHz. As the time base of the instrument is different from the external time base, the difference arising from the time base should be taken into consideration in bandwidth setting on the premise that the center frequency setting conforms to the requirements. According to the measured frequency error and the signal capture range, select the minimum IF bandwidth to obtain more accurate measurement results.

● Automatic search setting: 4992A has the function of automatic search. The input signal of the port can be searched automatically for conveniences of testing of unknown frequency signals. Click "Automatic Search" in the window or [Automatic Search] in the [Receiver Setting] menu to enable the function of automatic search.

➢ Measurement result display: the measured RF frequency error is the real-time frequency deviation. Therefore, the averaging of measurement results can be set according to the stability requirements. In particular, when the tested signal is the FM signal of low modulation rate, measurement results will change constantly. In this case, the user can set the averaging of measurement results to stabilize the display effects in the following method: click the [Average] soft key in the right side of the touch screen, open "Average", click the [Averaging Times] soft key in the right side of the touch screen, and the measurement result will be displayed after averaging according to the set times.

➢ Alarm setting: judge whether the measurement result conforms to the requirements. If it is beyond the range, the alarm color will be displayed to make the judgment more intuitive. Click "Alarm Setting" in the window, or click the [Alarm Setting] soft key in the right menu to open the alarm setting window, and set the upper alarm limit and lower alarm limit. Note

that the alarm setting must be within the measurement range between the upper and lower limit.

3. Strength of received signal

The RF meter of 4992A can measure the narrow-band signal power within the IF bandwidth of the receiver. It is designed for the RF ANT and T/R port. The user can select the appropriate port for input of the tested signal according to the power range of the input signal.

➢ Window opening: open the RF meter window by pressing the [Transmitter] hard key or pressing the [Measurement] hard key and setting the instrument menu. Select the window, and press the [Full Screen] hard key in the lower part of the screen to maximize the window, as shown in Fig. 4-7.

Fig. 4-7 Received Signal Strength Measurement Window

➢ Menu calling: click the touch screen, select the RF meter as the current active window, and the corresponding menu will be displayed in the right side of the window, as shown in Fig. 4-7.

➢ Receiver setting: when the RF meter window is opened, the receiver setting window will pop up at the same time. Click the interface or the right soft key menu, and set the receiver port, frequency, reference level, IF bandwidth, automatic search, etc. The setting method and procedures are the same as those of RF frequency error measurement and thus not repeated here.

➢ Display of measurement results:
● Unit selection: click the [Unit] soft key in the right menu, and select the measurement unit: dBm, W, μV and dBμV.
● The measured strength of the received signal is the real-time narrow-band power. Therefore, the averaging of measurement results can be set according to the stability requirements. In particular, when the tested signal is the AM signal of low modulation rate, measurement results will change constantly. In this case, the user can set the averaging of measurement results to stabilize the display effects in the following method: click the [Average] soft key in the right side of the touch screen, open "Average", click the [Averaging Times] soft key in the right side of the touch screen, and the measurement result will be displayed after averaging according to the set times.
● Alarm setting: judge whether the measurement result conforms to the requirements. If it is beyond the range, the alarm color will be displayed to make the judgment more intuitive. Click "Alarm Setting" in the window, or click the [Alarm Setting] soft key in the right menu to open the alarm setting window, and set the upper alarm limit and

lower alarm limit. Note that the alarm setting must be within the measurement range between the upper and lower limit.

4. Amplitude modulation depth

The amplitude modulation depth measurement with the demodulation meter of 4992A means the demodulation analysis of the amplitude modulation wave within the IF bandwidth of the receiver. This is designed for the RF ANT and T/R port. The user can select the appropriate   port for input of the tested signal, according to the power range of the input port.

➢   Window opening: open the demodulation meter window by pressing the [Transmitter] hard key or pressing the [Measurement] hard key and setting the instrument menu, and select the demodulation type "AM" in the receiver setting window that is opened at the same time. Select the demodulation meter and press the [Full Screen] hard key in the lower part of the screen to maximize the window, as shown in Fig. 4-8.
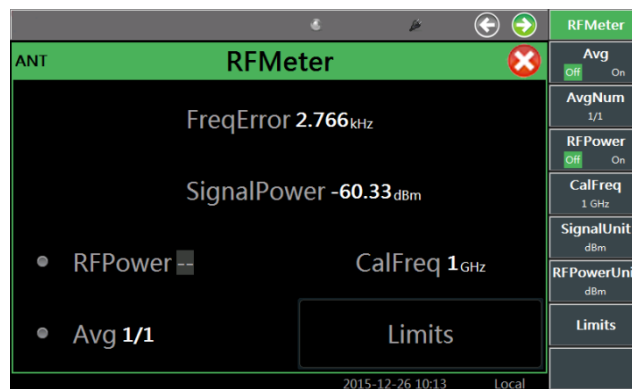

Fig. 4-8 Display Window of Amplitude Modulation Depth Measurement

➢   Menu calling: click the touch screen, select the demodulation meter as the current active window, and the corresponding menu will be displayed in the right side of the window, as shown in Fig. 4-8.
➢   Receiver setting:
    ●   Setting of conventional parameters such as the port: when the RF meter window is opened, the receiver setting window will pop up at the same time. Click the interface or the right soft key menu, and set the receiver port, frequency, reference level, IF bandwidth, automatic search, etc., as shown in Fig. 4-9. The setting method and procedures are the same as those of RF frequency error measurement and thus not repeated here.
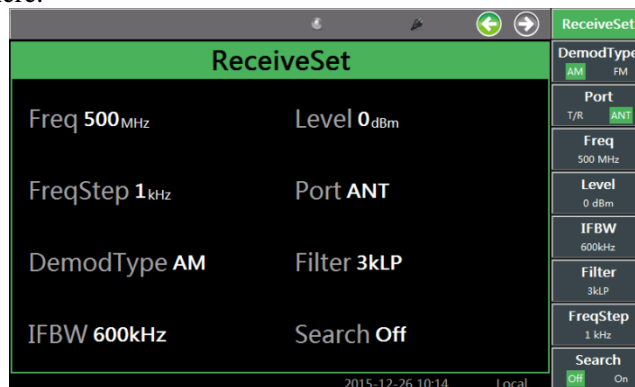
Fig. 4-9Receiver Setting Window

- Setting of demodulation type: click the "Demodulation Type" in the receiver setting window or the [Demodulation Type] soft key in the right [Receiver Setting] menu to select the demodulation type, AM or FM.
- Setting of audio filter: click the "Audio Filter" in the receiver setting window or [Audio Filter] in the right [Receiver Setting] menu. The low-pass, high-pass or band-pass filter can be selected according to the modulation rate. Optional filter types are as follows: 0.3-20kBP, 0.3-5kBP, 0.3-3kBP, 0.3kHP, 15kLP, 5kLP, 3kLP, 0.3kLP, etc.

➢ Display of measurement results:
- The averaging of measurement results can be set according to the stability requirements. Click the [Average] soft key in the right side of the touch screen, open "Average", click the [Averaging Times] soft key in the right side of the touch screen, and the measurement result will be displayed after averaging according to the set times.
- According to the distortion requirements of demodulation results, the SINAD and distortion measurement are added in the demodulation meter. Distortion measurement is divided into two types: THD (harmonic distortion) and THD+N (total distortion). The user can select the type according to the requirements.
- Alarm setting: judge whether the measurement result conforms to the requirements. If it is beyond the range, the alarm color will be displayed to make the judgment more intuitive. Click "Alarm Setting" in the window, or click the [Alarm Setting] soft key in the right menu to open the alarm setting window, and set the upper alarm limit and lower alarm limit. Note that the alarm setting must be within the measurement range between the upper and lower limit.

5. Frequency modulation deviation

The measurement of frequency modulation deviation with the demodulation meter of 4992A means the demodulation analysis of the demodulation wave within the IF bandwidth of the receiver. This is designed for the RF ANT and T/R port. The user can select the appropriate port for input of the tested signal, according to the power range of the input signal.

➢ Window opening: open the demodulation meter window by pressing the [Transmitter] hard key or pressing the [Measurement] hard key and setting the instrument menu, and select the demodulation type "FM" in the receiver setting window that is opened at the same time. Select the demodulation meter and press the [Full Screen] hard key in the lower part of the screen to maximize the window, as shown in Fig. 4-10.
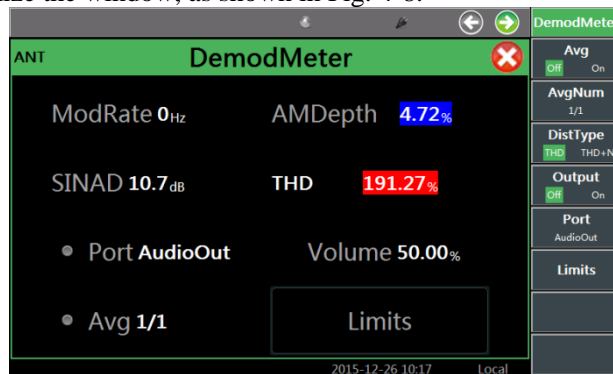
Fig. 4-10 Display Window of Frequency Modulation Deviation Measurement

➢ Menu calling: click the touch screen, select the demodulation meter as the current active window, and the corresponding menu will be displayed in the right side of the window, as shown in Fig. 4-10.

➢ Measurement setting [Receiver Setting]:

● Setting of conventional parameters such as the port: when the RF meter window is opened, the receiver setting window will pop up at the same time. Click the interface or the right soft key menu, and set the receiver port, frequency, reference level, IF bandwidth, automatic search, etc. The setting method and procedures are the same as those of RF frequency error measurement and thus not repeated here. Note that the tested signal is the frequency modulation wave. The frequency deviation of the carrier and the value of the frequency modulation deviation should be taken into consideration when the IF bandwidth is set.

● Setting of demodulation type: click the "Demodulation Type" in the receiver setting window or the [Demodulation Type] soft key in the right [Receiver Setting] menu to select the demodulation type, AM or FM.

● Setting of audio filter: click the [Audio Filter] in the right [Receiver Setting] menu. The low-pass, high-pass or band-pass filter can be selected according to the modulation rate. Optional filter types are as follows: 0.3-20kBP, 0.3-5kBP, 0.3-3kBP, 0.3kHP, 15kLP, 5kLP, 3kLP, 0.3kLP, etc.

➢ Display of measurement results:

● The averaging of measurement results can be set according to the stability requirements. Click the [Average] soft key in the right side of the touch screen, open "Average", click the [Averaging Times] soft key in the right side of the touch screen, and the measurement result will be displayed after averaging according to the set times.

● According to the distortion requirements of demodulation results, the SINAD and distortion measurement are added in the demodulation meter. Distortion measurement is divided into two types: THD (harmonic distortion) and THD+N (total distortion). The user can select the type according to the requirements.

● Alarm setting: judge whether the measurement result conforms to the requirements. If it is beyond the range, the alarm color will be displayed to make the judgment more intuitive. Click "Alarm Setting" in the window, or click the [Alarm Setting] soft key in the right menu to open the alarm setting window, and set the upper alarm limit and lower alarm limit. Note that the alarm setting must be within the measurement range between the upper and lower limit.

6. Spectrum analyzer (optional)

The spectrum analyzer function of 4992A is designed for the RF ANT and T/R port. The user can select the appropriate port for input of the tested signal, according to the power range of the input signal. Except the RF source, the spectrum analyzer cannot be enabled at the same time with other meter functions.

➢ Window opening: open the spectrum analyzer window by pressing the [Measurement] hard key and setting the instrument menu. Press the [Full Screen] hard key in the lower part of the screen to maximize the window, as shown in Fig. 4-11.

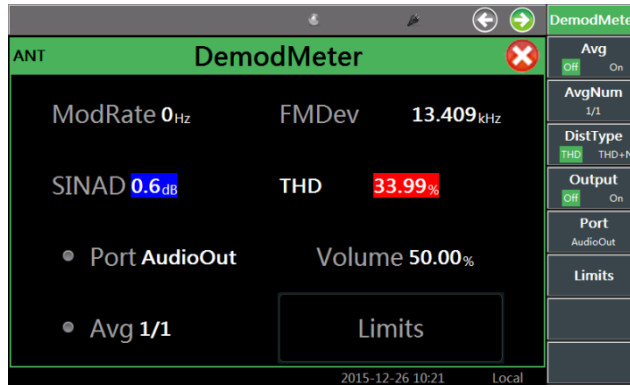Fig. 4-11 Spectrum Analyzer Display Window

➢ Menu calling: click the touch screen, select the spectrum analyzer as the current active window, and the corresponding menu will be displayed in the right side of the window, as shown in Fig. 4-11.Measurement setting:

● Setting of input port: click the [Input Port] soft key in the right menu, and select the appropriate input port for input of the tested signal, according the power range of the input signal.

● Frequency setting: estimate the frequency of the input signal, click the [Center Frequency] soft key in the right menu, and set the center frequency.

● Setting of frequency step: in order to change the center frequency more easily, click the [Set Center Frequency Step] soft key in the right menu, and enter the center frequency step with hard keys in the number zone, or change the center frequency step with the knob, [↑] or [↓]. Note that the step value is 1, 3, or 5 when changed with the knob, [↑] or [↓].

● Setting of reference level: click the [Reference] soft key in the right menu, and enter the reference level with hard keys in the number zone, or change the reference level with the knob, [↑] or [↓]. Note that the step is 10dBm when changed with the knob, [↑] or [↓].

● Setting of sweep width: click the [Sweep Width] soft key in the right menu and enter the sweep width value with hard keys in the number zone, or change the sweep width with the knob, [↑] or [↓]. Note that the step is 1, 3 or 5 when changed with the knob, [↑] or [↓].

● Setting of resolution bandwidth: click the [Resolution Bandwidth] soft key in the right menu and enter the resolution bandwidth value with hard keys in the number zone, or change the resolution bandwidth with the knob, [↑] or [↓]. Note that the step is 1, 3 or 5 when changed with the knob, [↑] or [↓]. The maximum resolution bandwidth is 30kHz.

● Cursor setting: click the [Cursor] soft key in the right menu to enter the menu of next level. Here, at most four cursors can be opened by means of [ON OFF] control; the normal or differential mode of the cursor can be controlled with the [Mode] soft key, in which the difference between different signals can be displayed intuitively; and the cursor can be positioned by sliding on the screen with the [Position] function. In addition, the cursor can be directly set as the "Peak", "Left Peak", "Right Peak", "Maximum" and "Minimum". After cursor setting, the center frequency can be changed by "→Center Frequency" to facilitate observation of signal characteristics.

● Advanced setting: click [Advanced] in the right menu to enter the menu of next level, and set the bandwidth, SPAN/RBW and average. The averaging of measurement results can be set according to the stability requirements. When "Average" is ON, the measurement result will be displayed after averaging according to the set times.

Section 3 Operation Guidance for Cable Test Function

This part describes some operations for online cable testing with 4992A Radio Test Set.

1. Standing wave ratio/return loss

The return loss or standing wave ratio (hereinafter referred to SWR) is a kind of expression of reflection characteristics. The return loss or SWR test can be done to single-port or double-port devices in engineering applications, as shown in (1) and (2) in Fig. 4-12 respectively.

Fig. 4-12 Connection for Return Loss/SWRMeasurement

➢ Window opening: open the cable test window by pressing the [Cable] hard key or pressing the [Measurement] hard key and setting the instrument menu. Press the [Full Screen] hard key in the lower part of the screen to maximize the window, as shown in Fig. 4-13.
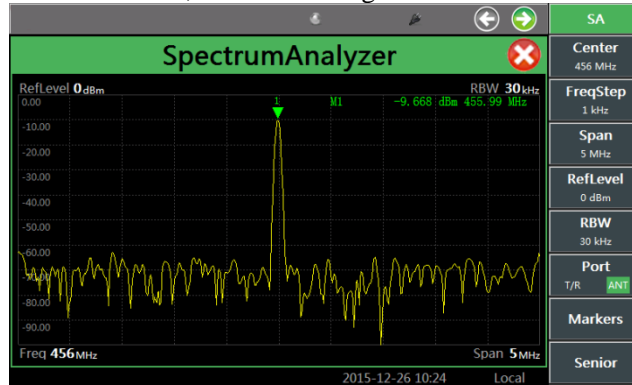
Fig. 4-13 Return Loss Test Interface

➢ Menu calling: click the touch screen, select the cable test as the current active window, and the corresponding menu will be displayed in the right side of the window, as shown in Fig. 4-13.

➢ Measurement setting:
  ● Frequency setting: click [Frequency Setting] soft key in the right menu, and set the starting frequency and stop frequency.
  ● Test type: click [Test Type] in the right menu, and select the test type [SWR] (standing wave ratio) or [RL] (return loss).
  ● Calibration: click the [Calibration] soft key in the right menu and then click [Start Calibration]. Connect the calibration kit according to the prompt. After calibration, connect the tested cable to the test instrument, and then connect the matching load to the cable end. The measured return loss curve will be displayed on the test instrument, as shown in Fig. 4-14.

Fig. 4-14 Return Loss Test Results

➢ Display of measurement results:
  ● Display setting: click the [Display Setting] soft key in the right menu to enter the menu of next level, and set the top value and bottom value of the vertical axis. The display setting of the vertical axis can be adjusted automatically by clicking [Automatic Setting].
  ● Display mode: click the [Display Mode] soft key in the right menu and select "Refresh" or "Hold" as the current mode.
  ● Cursor setting: click the [Cursor] soft key in the right menu to enter the menu of next level, and enable the cursor function to view the standing wave ratio or return loss of the cable in the specific position. At most three cursors can be opened at the same time by

[ON OFF] setting. The cursor can be dragged into the ideal position by selecting the [Position] soft key, or rapidly positioned by directly selecting the [Peak], [Left Peak] or [Right Peak]. The normal or differential mode can be selected with the [Mode] soft key. In the differential mode, two cursors can be compared intuitively. For example, the return loss of the cable is 28.79 at the frequency of 401.2MHz, and the standing wave ratio is 1.08, as shown in Fig. 4-15.
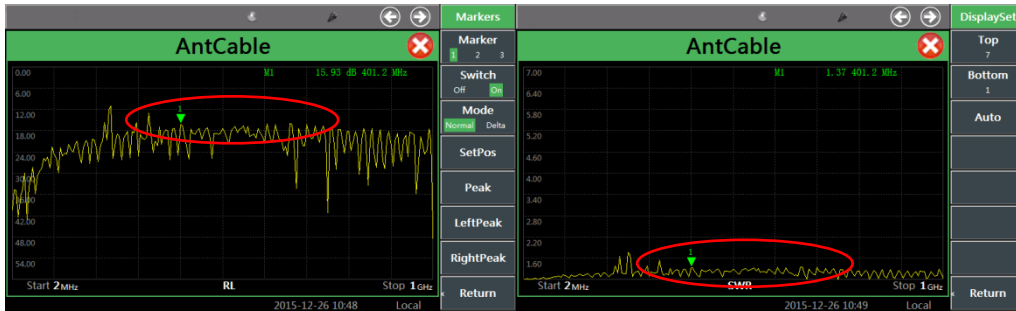
Fig. 4-15 Return Loss and Standing Wave Ratio Test Diagram at 401.2MHz

⚠	**CAUTION:**	The return loss or standing wave ratio refers to the matching degree of each frequency point of the tested device within the whole frequency band. The sweep width can be set according to the working frequency of the tested cable or tested device in the test.

2. Cable loss

The cable loss refers to the energy consumption of the cable in signal transmission. Generally, the cable loss is characterized with the average. In the test process, the cable loss is generally measured in the following connection method, as shown in Fig. 4-16.
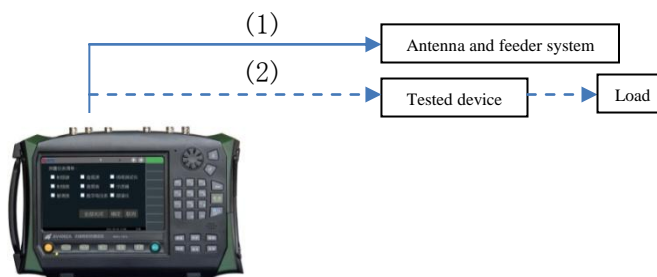

Fig. 4-16 Connection of Cable Loss Measurement

➢ Window opening: open the cable test window by pressing the [Cable] hard key or pressing the [Measurement] hard key and setting the instrument menu. Press the [Full Screen] hard key in the lower part of the screen to maximize the window, as shown in Fig. 4-17.
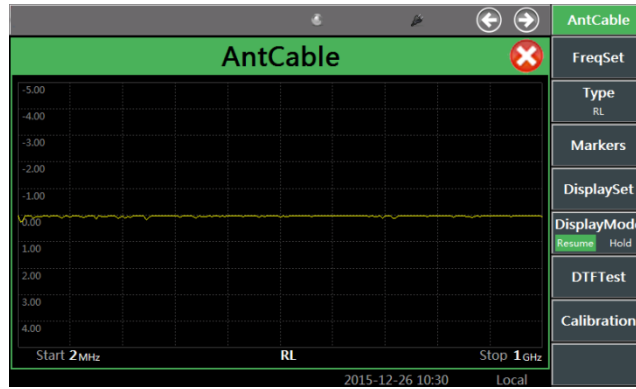

Fig. 4-17 Cable Loss Test Interface

➢ Menu calling: click the touch screen, select the cable test as the current active window, and the corresponding menu will be displayed in the right side of the window, as shown in Fig. 4-17.

➢ Measurement setting:

● Frequency setting: click the [Frequency Setting] soft key in the right menu, and set the starting frequency and stop frequency.

● Setting of test type: click the [Test Type] soft key in the right menu and select the test type [LOSS] (cable loss).

● Calibration: click the [Calibration] soft key in the right menu and then click [Start Calibration]. Connect the calibration kit according to the prompt. After calibration, connect the tested cable to the test instrument. In order to ensure the accuracy of cable loss measurement, connect the terminal of the tested cable to the open-circuit or short-circuit device. The measured cable loss curve will be displayed on the test instrument, as shown in Fig. 4-18.
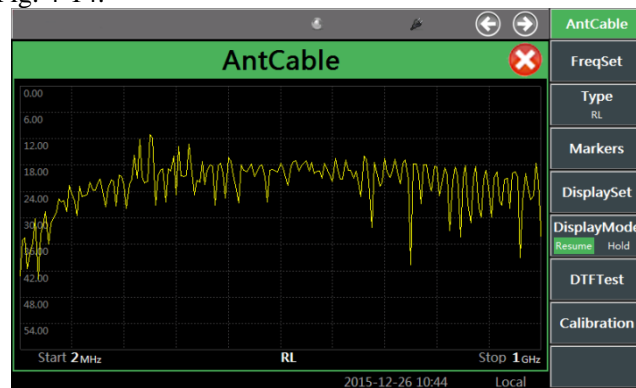

Fig. 4-18 Cable Loss Test Results

➢ Display of measurement results:
● Display setting: click the [Display Setting] soft key in the right menu to enter the menu of next level, and set the top value and bottom value of the vertical axis. The display setting of the vertical axis can be adjusted automatically by clicking [Automatic Setting].
● Display mode: click the [Display Mode] soft key in the right menu and select "Refresh" or "Hold" as the current mode.
● Cursor setting: click the [Cursor] soft key in the right menu to enter the menu of next level, and enable the cursor function to view the standing wave ratio or return loss of the cable in the specific position. At most three cursors can be opened at the same time by [ON OFF] setting. The cursor can be dragged into the ideal position by selecting the [Position] soft key, or rapidly positioned by directly selecting the [Peak], [Left Peak] or [Right Peak]. The normal or differential mode can be selected with the [Mode] soft key. In the differential mode, two cursors can be compared intuitively. After the loss curve of the tested cable is measured, the user can use the [Cursor] soft key to find the peak and valley value of this loss curve. Then calculate the average to obtain the average loss of the cable.

3. DTF measurement

DTF (Distance To Fault) measurement. i.e. fault point positioning measurement, is a kind of performance verification and fault analysis tool used in the maintenance and repair process of antenna and transmission lines. In engineering applications, the connection method shown in Fig.

4-19 is generally applied in DTF measurement for fault point status measurement of connecting cables of the base station, etc.
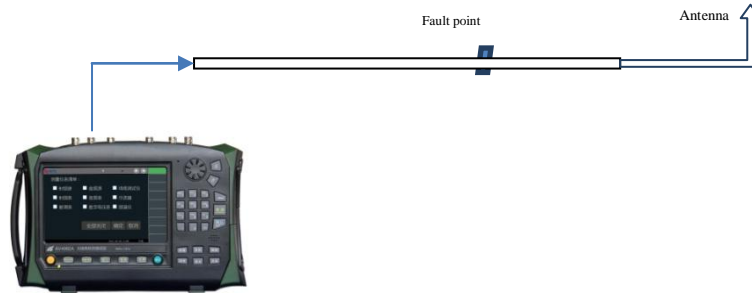
Fig. 4-19 Schematic Diagram of Connection of DTF Measurement
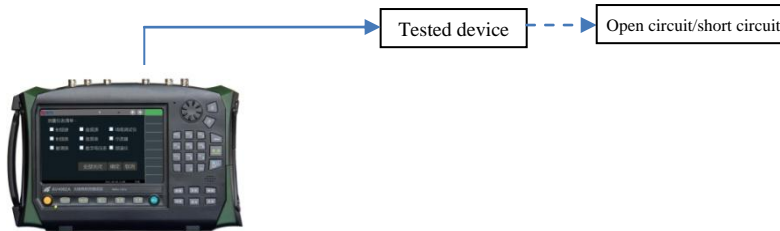
➢ Window opening: open the cable test window by pressing the [Cable] hard key or pressing the [Measurement] hard key and setting the instrument menu. Press the [Full Screen] hard key in the lower part of the screen to maximize the window, as shown in Fig. 4-20.
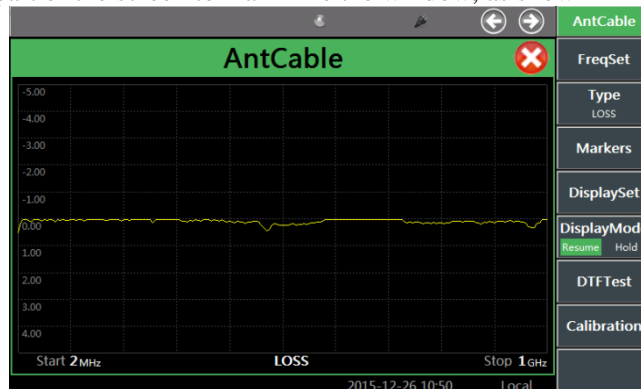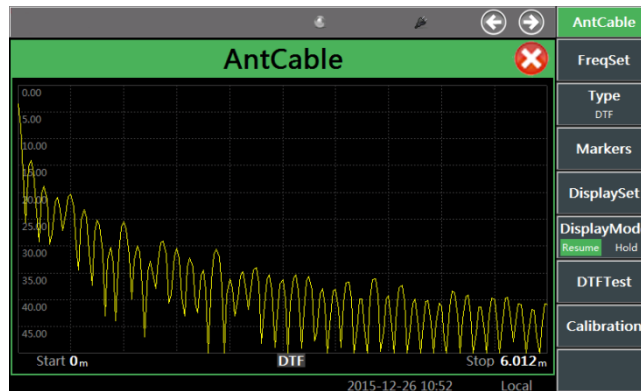

Fig. 4-20 DTFMeasurement Window

➢ Menu calling: click the touch screen, select the cable test as the current active window, and the corresponding menu will be displayed in the right side of the window, as shown in Fig. 4-20.

➢ Measurement setting:
- Frequency setting: click the [Frequency Setting] soft key in the right menu, and set the starting frequency and stop frequency.
- Setting of test type: click the [Test Type] soft key in the right menu and select the test type [DTF] (fault point positioning measurement).
- DTF test setting:
  ✧ Setting of cable type: click [DTF Test]→[Cable Type] in the right menu and select the cable type. 4992A is provided with a series of commonly used cable models to be called by the user, as shown in Fig. 4-21. Select the corresponding cable mode with the touch screen, knob, [↑] or [↓], and click the [Select] soft key or press the [OK] hard key. Thus the cable model is called. In this case, the speed factor, cable loss and other parameters can be matched automatically according to the selected cable model.
  ✧ Setting of relative speed: click the [DTF Test] soft key in the right menu of the window and set the relative speed, i.e. speed factor of the cable (the speed factor refers to the electromagnetic wave transmission speed in the cable and the speed of light, i.e. 0-1).
  ✧ Setting of cable loss: refer to the signal loss within the unit length.

> ⚠ **CAUTION:** Note that the speed factor and cable loss are inherent parameters of the cable. In case of any ambiguity, consult the cable specifications or cable manufacturer. The user cannot manually set the speed factor, unit loss, etc. until "User" is set under [Cable Type].

✧ Setting of length estimate: after the frequency range is set, the distance estimate will be set automatically. In order to facilitate observation, the length estimate can be reduced properly within this range.
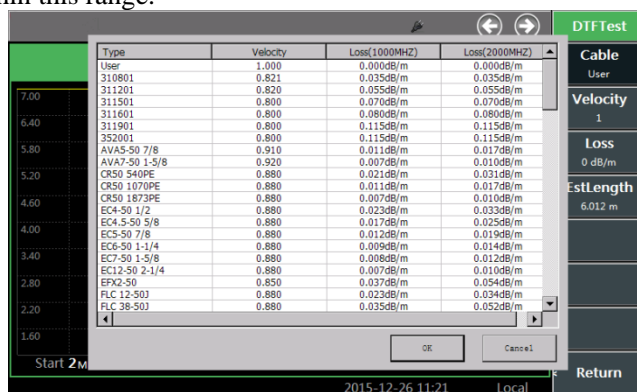
Fig. 4-21 Cable Type Calling Interface

● Calibration: click the [Calibration] soft key in the right menu and then click [Start Calibration]. Connect the calibration kit according to the prompt. After calibration, connect the tested cable to the test instrument. If only the length of the tested intact cable needs to be estimated, connect the open-circuit or short-circuit device (as the fault point) to the terminal of the tested cable to provide the obvious peak point for reading of the cable length.
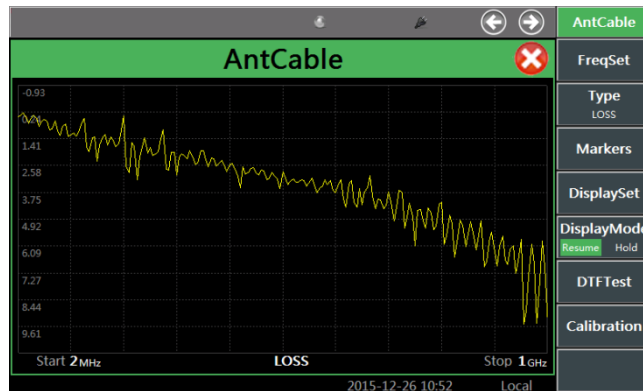
➢ Display of measurement results:
● Display setting: click the [Display Setting] soft key in the right menu to enter the menu of next level, and set the top value and bottom value of the vertical axis. The display setting of the vertical axis can be adjusted automatically by clicking [Automatic Setting].
● Display mode: click the [Display Mode] soft key in the right menu and select "isplay m or "or la as the current mode.
➢ Cursor setting: click the [Cursor] soft key in the right menu to enter the menu of next level, and enable the cursor function to view the standing wave ratio or return loss of the cable in the specific position. At most three cursors can be opened at the same time by [ON OFF] setting. The cursor can be dragged into the ideal position by selecting the [Position] soft key, or rapidly positioned by directly selecting the [Peak], [Left Peak] or [Right Peak]. The normal or differential mode can be selected with the [Mode] soft key. In DTF measurement, the cursor is generally positioned at the peak (i.e. fault point) so as to read the position of the fault point, i.e. the distance between the fault point and the measurement point of the test instrument. The measured fault point position is shown in Fig. 4-22.
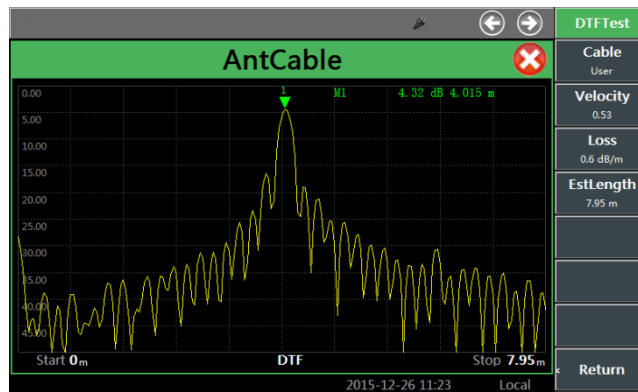
Fig. 4-22 DTF Test Curve

⚠	**CAUTION:**	After frequency setting, the current maximum test distance can be determined (shown in the lower right corner of the display zone of the instrument). The user can properly reduce this distance according the maximum value and the estimated position of the tested fault point.

Section 4 Operation Guidance for Call Function

This part describes some operations of 4992A Radio Test Set in the call test.

The instrument will be used for transmission and reception in the call. When two instruments are involved in the call, the transmitter and receiver signals can be transmitted through the antenna or connected through the cable. Note that the corresponding carrier frequency, modulation type and demodulation type of the transmitter and receiver should be the same.

In the call function, the audio signal received after demodulation will be automatically sent to the audio box port so as to be heard through the audio box speaker. If the PTT switch is pressed in the call, the MIC signal collected by this instrument will be modulated and transmitted as the output; and if the PTT switch is released, the received signal will be demodulated and transmitted to the audio box speaker as the output.

Fig. 4-23 Schematic Diagram of Call Connection

➢ Window opening: four windows, i.e. RF source, modulation source, demodulation meter and receiver setting, will pop up automatically if the [Call] hard key is pressed. The demodulation meter window can be maximized by pressing the [Full Screen] hard key in the lower part of the screen, as shown in Fig. 4-24.
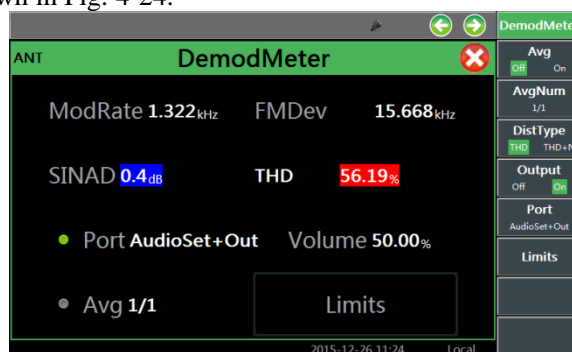
Fig. 4-24 Call Window Display

➢ Call setting:

● Transmitter setting: the transmitter is set according to the above setting requirements of the RF source window. The carrier frequency, modulation type, modulation frequency and modulation degree should be set the same as those of the receiver. Generally, "External MIC" is selected as the modulation source.

● Receiver setting: set the input port, demodulation type, carrier frequency and reference level

in the call window according to the transmitter requirements. The specific receiver demodulation settings can be changed in the right menu of the call window, such as the IF bandwidth, audio filter, etc. The setting method is the same as that of the demodulation meter.

● Setting of audio box: the volume can be properly adjusted between 0% and 100% according to the sound strength of the audio box.

Section 5 Operation Guidance for Audio Function

This part describes some operations of 4992A Radio Test Set for audio signal generation and measurement.

1. Setting of audio source and noise source

4992A is equipped with double audio sources: Audio Source 1 and 2. The audio sources can be separately selected for signal output or combined for output. In addition, this instrument is also provided with one noise source, which can be applied separately or combined with one audio source for output.

➢ Window opening: open and select the audio source window by pressing the [Audio] hard key or pressing the [Measurement] hard key and setting the instrument menu, and maximize this window by pressing the [Full Screen] hard key in the lower part of the screen, as shown below.
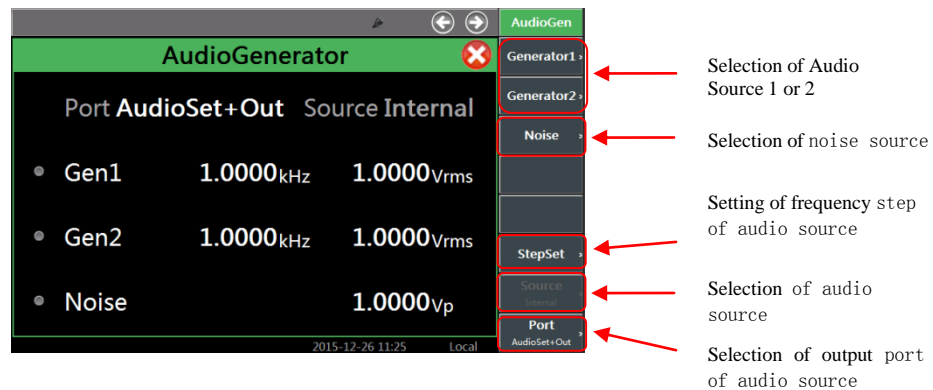
Fig. 4-25 Audio Source Output Port

➢ Menu calling: click the touch screen, select the audio source window, and the corresponding menu will pop up in the right side.

➢ Setting of output source: set one audio source, double audio sources or noise+audio source by clicking the button in front of the Audio Source 1, Audio Source 2 and noise source in the window. You can also click [Audio Source 1], [Audio Source 2] or [Noise Source] in the right menu to select the output source.

For example, click [Audio Source 1] in the right menu, open [Audio Source 1], and the window shown in Fig. 4-26 will pop up, in which Audio Source 1 is selected for the output.
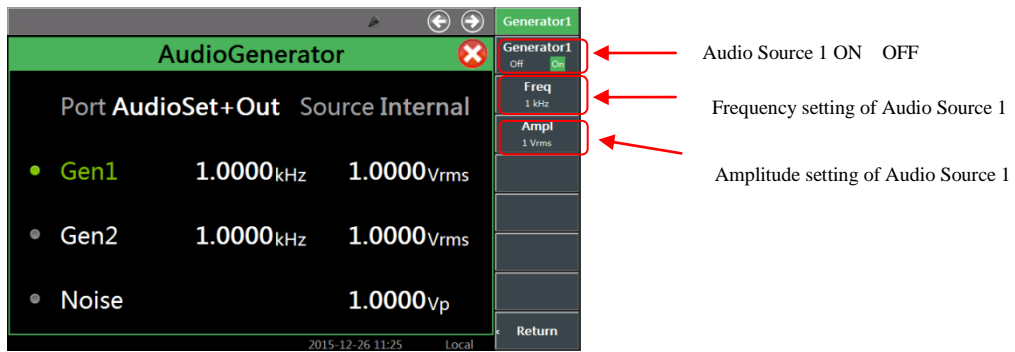
Fig. 4-26 Audio Source Setting Window

For example, click [Noise Source] in the right menu, open [Noise Source], and the window shown in Fig. 4-27 will pop up, in which the noise source is selected for the output.
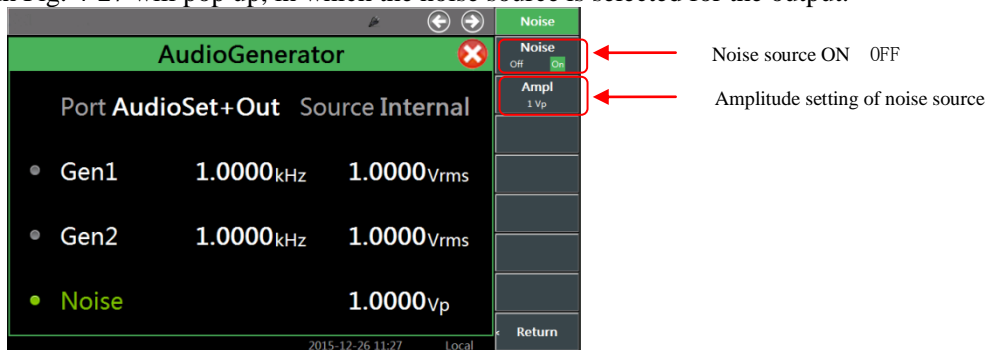
Fig. 4-27 Noise Source Setting Window

➢ Frequency and amplitude setting: click the frequency and amplitude of Audio Source 1 or 2 in the window, and set the output frequency and voltage amplitude of the corresponding audio source. This value can be entered with number keys on the front panel or changed step by step with the UP and DOWN key. The output voltage and amplitude of the noise source can be changed in the same method.

➢ Setting of output port: as shown in Fig. 4-28, select the audio or noise signal transmission to the audio output port and audio box speaker by clicking the drop-down menu on the right side of the output port in the audio source window or setting the right menu.
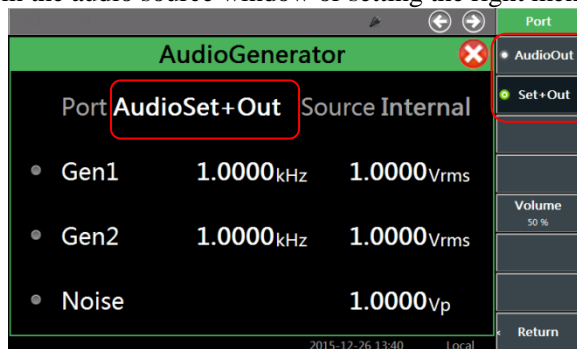
Fig. 4-28 Output Port Setting Window

⚠ **CAUTION:** As the loading capacity of the audio output port is limited, the average power of the noise source and the amplitude of the audio output will be limited correspondingly. When two audio sources are used for output at the same time, the sum of their output voltage must not exceed the maximum voltage of each output.

2. Setting of audio meter

The audio meter of 4992Ahas four test functions: frequency, voltage, SINAD and distortion. It is designed for the frequency, AC voltage and distortion analysis and measurement of external audio signals. The user should estimate the level range of the input signal and select the appropriate range.

➢ Window opening: open the audio meter window by pressing the [Audio] hard key or pressing the [Measurement] hard key and setting the instrument menu, and press the [Full Screen] hard key in the lower part of the screen to maximize this window, as shown below.

Fig. 4-29 Audio Meter Display Window

➢ Menu calling: click the touch screen, select the audio meter window, and the relevant setting menu will pop up in the right side.

➢ Measurement setting: select the appropriate input impedance and range, click "easure on the touch screen or the [Range] soft key in the right menu, and set the range as shown in Fig. 4-30.
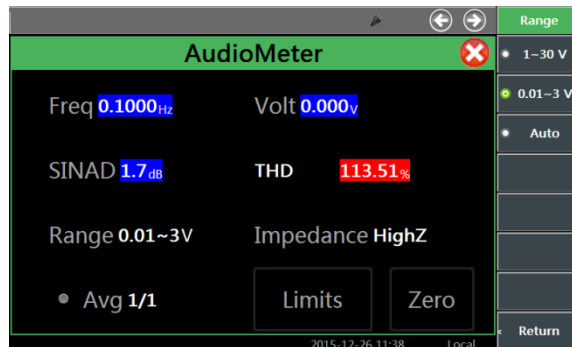
Fig. 4-30 Range Setting

Click [Impedance] on the touch screen, and select the appropriate input impedance. The set impedance is as shown in Fig. 4-31.
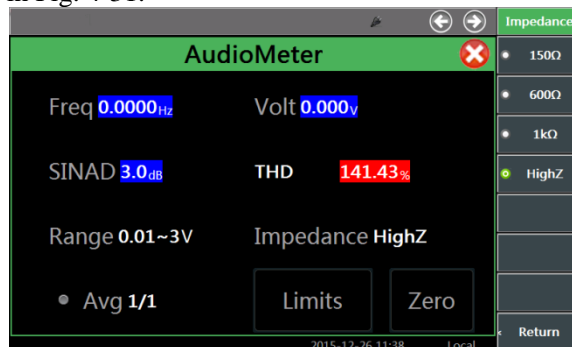
Fig. 4-31 Impedance Setting

The audio meter should be subject to zero calibration before the test. Fig. 4-29 shows the audio meter display window. Click "Zero Calibration" on the touch screen or the [Zero Calibration] soft key in the right side for zero calibration of the audio meter. Note that all connections should be disconnected before zero calibration.

➤ Display of measurement results:
● The averaging of measurement results can be set according to the stability requirements. In the audio meter display window shown in Fig. 4-29, click the [Average] soft key in the right side of the touch screen, and open "Average". Then click the [Averaging Times] key in the right menu of the touch screen, and the measurement result will be displayed after averaging according to the set times.
● Click the [Voltage Unit] soft key in the right menu of the touch screen, and select the output unit: V, mV, dBuV, dBm, W, etc. Note that if the display unit is power, the output power will be calculated according to the matching impedance of the system.
● The distortion type of the measurement can be set according to the requirements of signal distortion measurement results. Click the [Distortion Type] soft key in the right side of the touch screen: THD (harmonic distortion) and THD+N (total distortion). The user can select the distortion type according to the requirements.
➤ Alarm setting: judge whether the measurement result conforms to the requirements. If it is beyond the range, the alarm color will be displayed to make the judgment more intuitive. Click "Alarm Setting" in the window, or click the [Alarm Setting] soft key in the right menu to open the alarm setting window, and set the upper alarm limit and lower alarm limit. Note that the alarm setting must be within the measurement range between the upper and lower limit.

3. Setting of digital voltmeter

The digital voltmeter of 4992A is deigned for AC or DC voltage measurement of DVM input ports. The user can select the coupling mode according to the characteristics of the tested signal, estimate the level range of the input signal and select the appropriate range.

➤ Window opening: open the digital voltmeter window by pressing the [Measurement] hard key and setting the instrument menu, and press the [Full Screen] soft key in the lower part of the screen to maximize this window, as shown below.

Fig. 4-32 Digital Voltmeter Display Window

➤ Menu calling: click this touch screen, select the digital voltmeter window, and the relevant setting menu will pop up in the right side.
➤ Measurement setting:
● First select the measurement mode. Click the [Measurement Mode] soft key of the right menu in the touch screen for port setting, and select the DC or AC mode.
● Click the [Range Selection] soft key of the right menu of the touch screen for port setting. The range setting window of the digital voltmeter is shown in Fig. 4-33. Select the appropriate range.
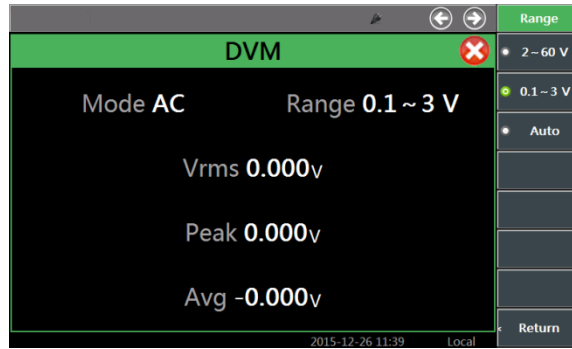
Fig. 4-33 Digital Voltmeter Range Setting Window

● The digital voltmeter should be subject to zero calibration before the test. Fig. 4-32 shows the digital voltmeter display window. Click "he digital voltme on the touch screen or the [Zero Calibration] soft key in the right side for zero calibration of the digital voltmeter. Note that all connections should be disconnected before zero calibration.

➢ Display of measurement results:

● In the digital voltmeter display window shown in Fig. 4-32, click the [Unit] soft key in the right side of the touch screen for port setting and select the appropriate unit.

● In the digital voltmeter display window shown in Fig. 4-32, click the [Resolution] soft key in the right side of the touch screen for port setting and select the appropriate resolution.

● The averaging of measurement results can be set according to the stability requirements. If "he avera is ON, the measurement result will be displayed after averaging according to the set times.

⚠	**CAUTION:**	One port is shared for external audio input and digital voltmeter signal input. If the tested signal is within the measurement range but the level cannot be easily estimated, the large range can be applied to determine the input level, and then the small range will be applied to make measurement results more accurate.

4. Setting of audio oscilloscope

The oscilloscope function of 4992A has the function of intuitive measurement display of low-frequency signals of the external audio, DVM or interval receiver signal after demodulation. This is designed for the external audio/DVM interface. The user should estimate the level range of the input signal, and select the appropriate range. The operation interface is shown in Fig. 4-34.

➢ Window opening: open the oscilloscope window by pressing the [Measurement] hard key and setting the instrument menu, and press the [Full Screen] hard key in the lower part of the screen to maximize the window, as shown below.
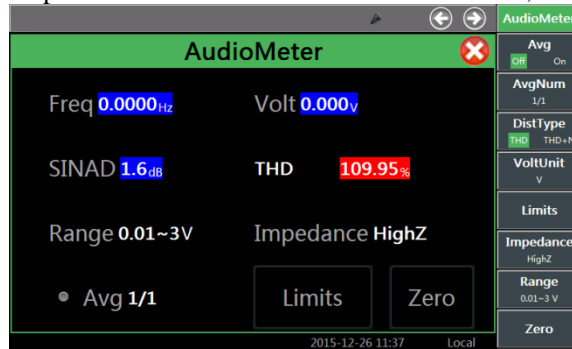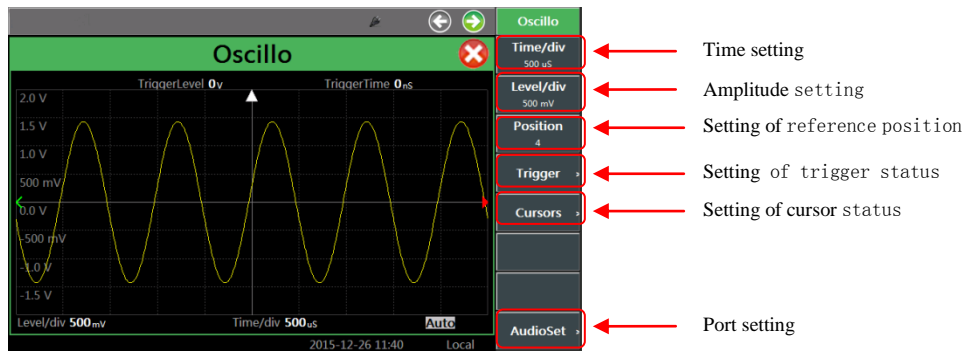
Fig. 4-34 Oscilloscope Display Window

➢ Menu calling: click the touch screen, select the oscilloscope window and the relevant setting menu will pop up in the right side.
➢ Setting of input port:

Click the [Port Setting] soft key in the right menu of the touch screen for port setting. Select the external audio, demodulation, DVM, etc. in the port setting window shown in Fig. 4-35.

Fig. 4-35 Port Setting Window

✧ Refer to Fig. 4-30 and 4-31 for external audio setting, and Fig. 4-9 for demodulation setting.
✧ After the demodulated audio signal is measured, select the appropriate measurement port, IF bandwidth, demodulation type, audio filter, etc. according to the level characteristics of the demodulated signal. Then connect the signal to the corresponding to the RF input port , and observe the measurement result.
✧ Set the DVM port by clicking the [DVM Setting] soft key in the right side of the touch screen for port setting, as shown in Fig. 4-36.
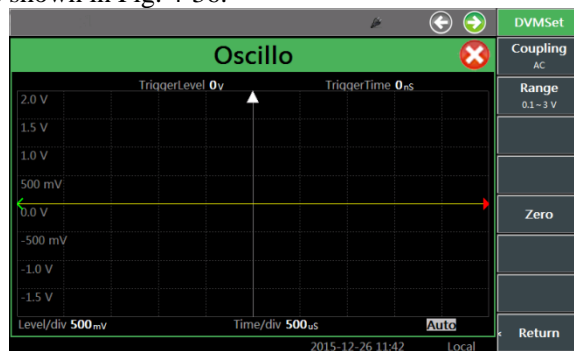
Fig. 4-36 DVM Setting Window

Click the [Zero Calibration] soft key in the right menu of the touch screen for zero calibration of the oscilloscope. Note that all connections should be disconnected before zero calibration.
Click the [Coupling Mode] soft key in the right menu of the touch screen, as shown in Fig. 4-37, and select the DC or AC mode.
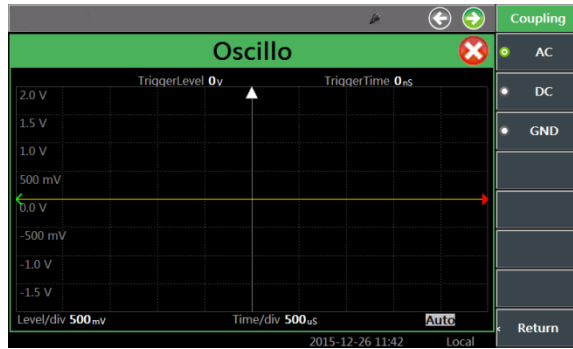
Fig. 4-37 Oscilloscope DVM Setting Window

Click the [Range Selection] soft key in the right side of the touch screen, as shown in Fig. 4-38, and select the appropriate range.

Fig. 4-38 Oscilloscope DVM Range Selection Window

➢ Trigger setting:
● In the operation interface shown in Fig. 4-34, click the [Trigger] soft key in the right men of the touch screen for port setting. The window shown in Fig. 4-39 will pop up.

Fig. 4-39 Oscilloscope Trigger Setting Window

●Click [Pulse Edge] in the right menu of the touch screen and select the rising or falling edge trigger.

●Click [Trigger Level] and [Trigger Position] in the right menu of the touch screen, and set the appropriate trigger level and position.

●Click [Trigger Mode] in the right menu of the touch screen, and the window shown in Fig. 4-40 will pop up. Select the trigger mode.
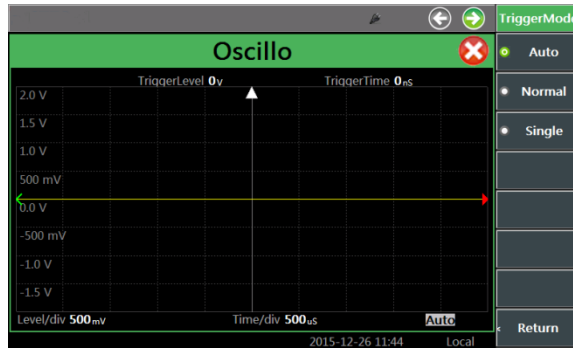
Fig. 4-40 Oscilloscope Trigger Mode Selection Window

➢ Display of measurement results:
● In the operation interface shown in Fig. 4-34, click [Time/Interval], [Amplitude/Interval], [Reference Position] and other soft keys in the right menu of the touch screen for port setting, and set the appropriate time, amplitude, reference position, etc.

In order to ensure the normal signal display of the oscilloscope, the recommended relationship between the horizontal-axis time setting, internal sampling rate setting and tested signal frequency is as follows.

Time setting (ms/div)	Actual sampling rate (kHz)	Frequency band (Hz)
0.2	250	10kHz-20kHz
0.5	100	5kHz-10kHz
1	50	2.5kHz-5kHz
2	25	1kHz-2.5kHz
5	10	500-1kHz
10	5	250-500
20	2.5	100-250
50-1000	1	100-10

● To mark the measurement result, click the [Cursor] soft key in the right men of the touch screen in the operation interface shown in Fig. 4-34. The window shown in Fig. 4-41 will pop up. First set the mode and select the cursor amplitude or time. Then select the cursor A or B, and enable the ON state of the cursor A or B.

●
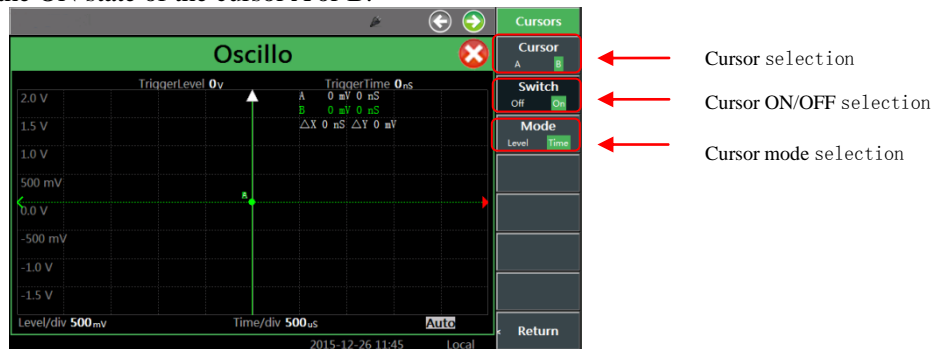
Fig. 4-41 Oscilloscope Cursor Window

⚠ **CAUTION:** The oscilloscope window is applied for auxiliary monitoring and display of low-frequency signals. It is separately used in general, except that the RF source and audio source are enabled at the same time.

Chapter V Menu Description

The keys in [] are hard keys, i.e. keys on the front panel. Soft menu items corresponding soft keys are provided in [ ].

1 Measurement

[Measurement]

The measurement instrument list selection window will pop up, including the RF source, audio source, cable tester, RF meter, audio meter, oscilloscope, demodulation meter, digital voltmeter and spectrum analyzer, as shown below.
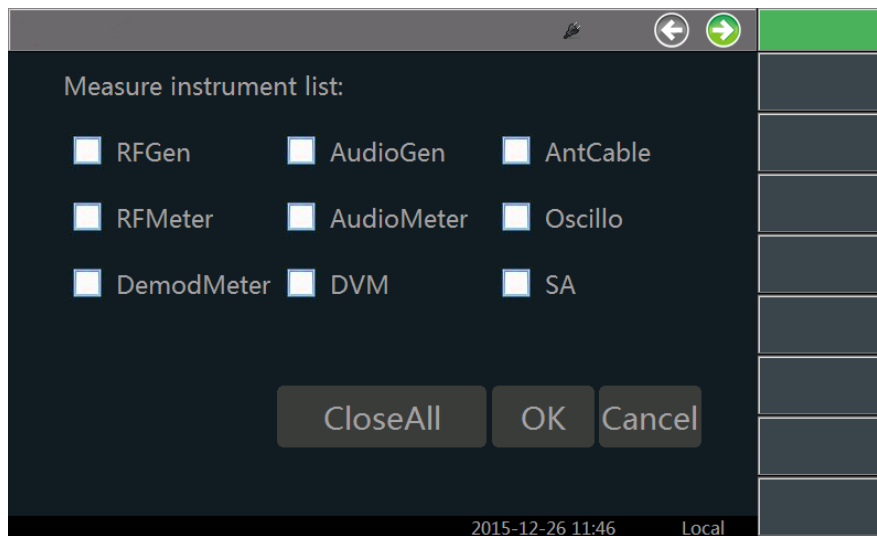
Fig. 5-1 [Measurement] Window

1.1RF source

Press the [Measurement] hard key, select the RF source in the screen, and click "OK". Open and select the RF source window, set the window focus as the RF source, and the [RF Source] function menu will pop up, including [Output Port], [RF source OFF ON], [Frequency], [Power] and [Step Setting]. They can be selected and set in the window or menu. The menu structure is as follows.

RFGen	Port	StepSet
Port SWR ›	⊙ SWR	FreqStep 1 kHz
Generator1 Off On	○ ANT	AmplStep 1 dBm
Freq 1 GHz	○ T/R	
Ampl -65 dBm		‹ Return
Generator2 Off On	‹ Return	
Freq 400 MHz		
Ampl -100 dBm		
StepSet ›		
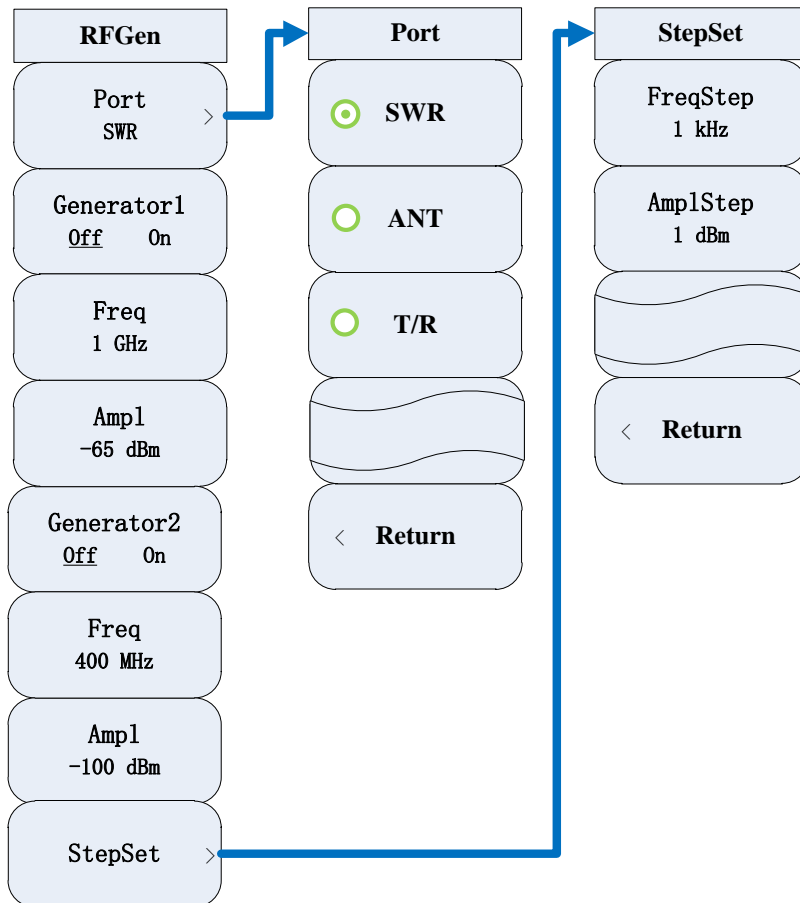
Fig. 5-2 [RF Source] Function Menu

[Output port]

Select the signal output port, including [SWR], [ANT] and [T/R]. If RF Source 2 is ON, only the ANT port can be selected.

[RF source OFF ON]

Open or close the corresponding RF source (RF Source 1 or 2). The RF source can be selected in the window or menu.

[Frequency]

Set the frequency of the corresponding RF source. The frequency can be adjusted with the number keys, step keys or knob.

[Power]

Set the power of the corresponding RF source. The power can be adjusted with the number keys, step keys or knob.

[Step setting]

Set the frequency step and amplitude step. The step can be adjusted with the number keys, step keys or knob.

1.1.1 Modulation source

The modulation source can be opened when the RF source is ON. Open the modulation source, select the modulation source window, set the window focus as the modulation source, and the [Modulation Source] function menu will pop up, including [Carrier], [Modulation Source], [Internal Audio Setting], [External Audio Impedance], [Amplitude Modulation AM OFF ON] and [FrequencyModulation FM OFF ON]. They can be selected and set in the window or menu. The menu structure is as follows.
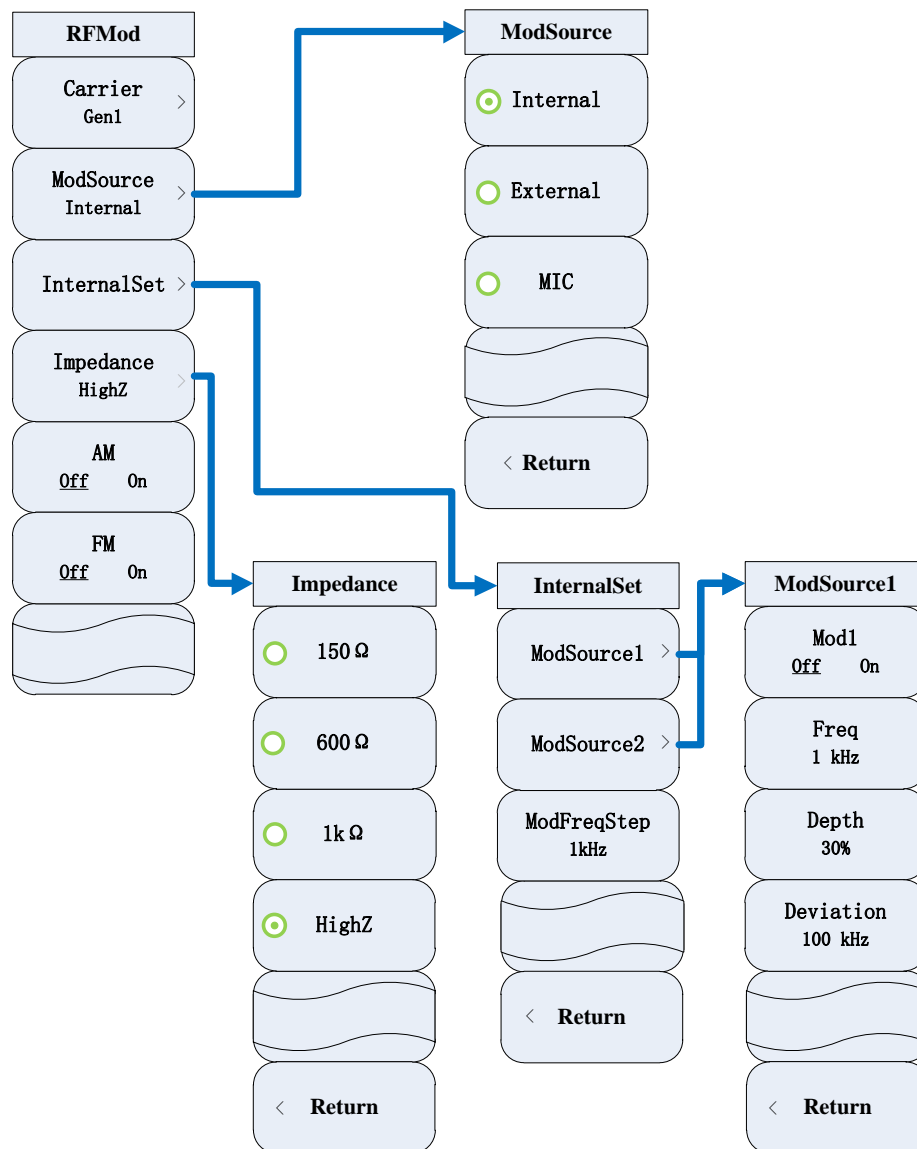
Fig. 5-3 [Modulation Source] Function Menu

[Carrier]

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Select the carrier. At present, RF Source 2 has no function of modulation. Therefore, [RF Source 1] is selected.

[Modulation Source]

Select the modulation source type, including [Internal Audio], [External Audio] and [External MIC].

[Internal audio setting]

Set the internal audio, i.e. modulation setting, including the ON/OFF status, frequency, amplitude modulation depth and frequency modulation deviation of the modulation source. The values can be adjusted with the number keys, step keys or knob.

[External audio impedance]

The external audio impedance can be set only when the modulation source is the external audio. Four kinds of impedance are optional: [150Ω], [600Ω], [1kΩ] and [High Impedance].

1.2RF meter

Press the [Measurement] hard key, select the RF meter in the screen, and click "OK" to open the RF meter. Select the RF meter window, and the [RF Meter] menu will pop up, including the [Average OFF ON], [Averaging Times], [RF Power], [Compensation Frequency of Frequency Response], [Signal Strength Unit], [RF Power Unit] and [Alarm Setting]. The menu structure is as follows.

Fig. 5-4 [RF Meter] Menu

[Average OFF ON]

Enable or disable the function of continuously averaging test results.

[Average frequency]

Set up average frequency.

[RF power]

Enable or disable the RF power testing function.

[Compensation frequency of frequency response]

Set the compensation frequency of frequency response of RF power measurement. The default value is 1GHz.

[Signal intensity unit]

Select the unit of signal strength display: [dBm], [W], [μV] or [dBμV]. The default unit is dBm.

[RF power unit]

Select the unit of signal strength display: [dBm], [W], [μV] or [dBμV]. The default unit is dBm.

[Alarm device]

Set the alarm value. The measured value within the set alarm limit will be displayed normally. If the measured value is larger than the upper alarm limit, the background will become green; and if

the measured value is smaller than the lower alarm limit, the background will become blue.

1.2.1 Receiver Setting

When the RF meter window is opened, the receiver setting window will pop up at the same time. Select the receiver setting window, and the [Receiver Setting] menu will pop up, including [Demodulation Type], [Input Port], [Frequency], [Reference], [IF Bandwidth], [Audio Filter], [Center Frequency Step] and [Search Mode]. The menu structure is as follows.

ReceiveSet	IFBW1/2	IFBW2/2	Filter1/2	Filter2/2
DemodType AM FM	○ 5kHz	○ 30kHz	○ 0.3-20kBP	○ 3kLP
Port T/R ANT	○ 6.25kHz	○ 60kHz	○ 0.3-5kBP	○ 0.3kLP
Freq 500MHz	○ 8.33kHz	○ 100kHz	○ 0.3-3kBP	
Level 0 dBm	○ 10kHz	○ 300kHz	○ 0.3HP	‹ Return
IFBW 600kHz ›	○ 12.5kHz	⊙ 600kHz	○ 15kLP	
Filter 3kLP ›	○ 25kHz		○ 5kLP	
FreqStep 1kHz	Next ›	‹ Return	Next ›	
Search Off On	‹ Return		‹ Return	
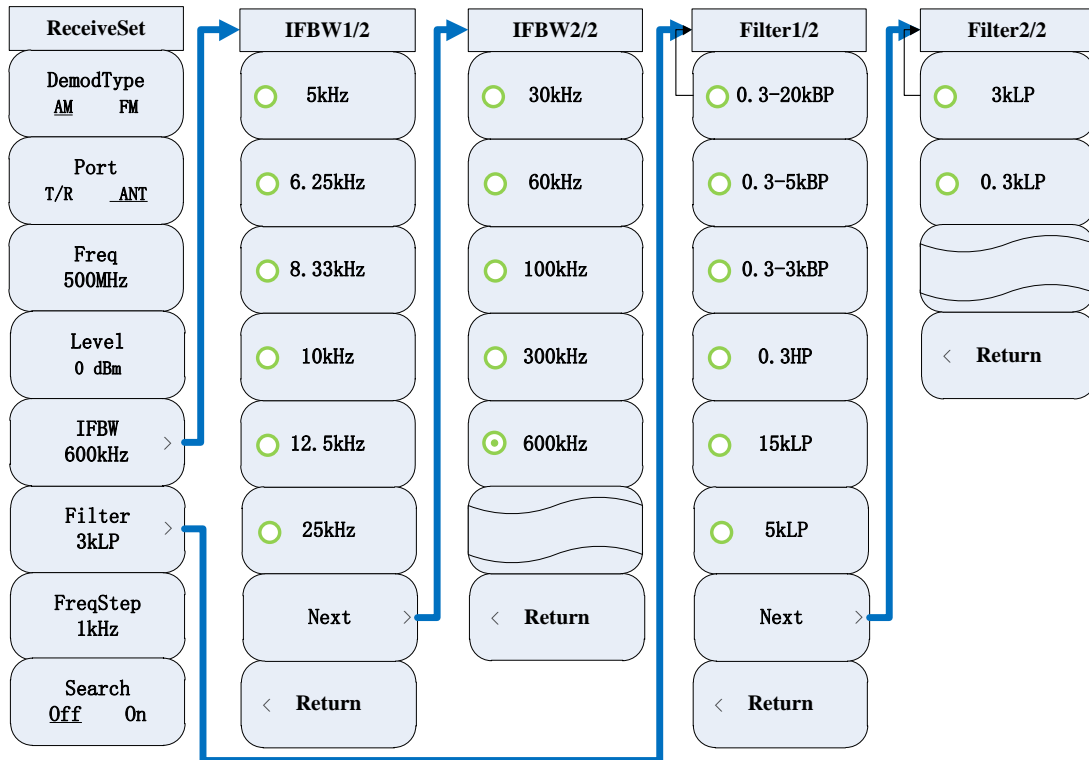
Fig. 5-5[Receiver Setting] Menu

[Demodulation type]

Set the demodulation type of the demodulation meter: AM or FM.

[Input port]

Select the T/R port or ANT port as the input port of the receiver.

[Frequency]

Set the input frequency. The input frequency can be adjusted with the number keys, step keys or knob. The frequency range is 2MHz to 1000MHz.

[Reference]

Set the reference level and enable the reference level setting function. The reference level can be

adjusted with the number keys, step keys or knob. The reference level range is -80dBm to 50dBm.

[Intermediate-frequency bandwidth]

Select the IF bandwidth: 5kHz, 6.25kHz8.33kHz, 10kHz, 12.5kHz, 25kHz, 30kHz, 60kHz, 100kHz, 300kHz or 600kHz.

[Audio filter]

Select the audio filter: 0.3-20kBP, 0.3-5kBP, 0.3-3kBP, 0.3HP, 15kLP、5kLP, 3kLP or 0.3kLP.

[Center frequency step]

Set the step of frequency adjustment. The frequency step can be adjusted with the number keys, step keys or knob.

[Automatic search]

Enable or disable the function of automatic search.

1.3Demodulation meter

Press the [Measurement] hard key, select the demodulation meter in the screen, and click "OK" to open and select the demodulation meter window. The [Demodulation Meter] soft key menu will pop up, including [Average OFF ON], [Averaging Times], [Distortion Type], [Output Port OFF ON], [Output Port] and [Alarm Setting]. The menu structure is as follows.
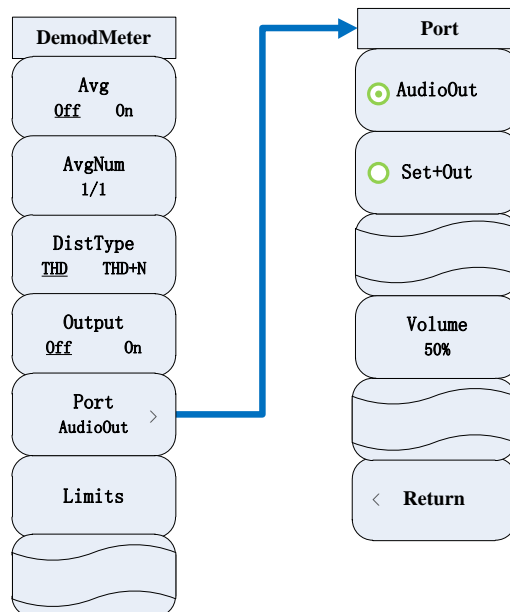
Fig. 5-6 [Demodulation Meter] Menu

[Average OFF ON]

Enable or disable the function of continuously averaging measurement results.

[Average frequency]

Set up average frequency.

[Distortion type]

Set the distortion type: THD and THD+N. The default setting is THD.

[Output port OFF ON]

Open or close the audio output port.

[Output port]

Set the audio output port: [Audio Output] and [Device+Output]. The output volume can be adjusted.

[Alarm device]

Set the alarm value. The measured value within the set alarm limit will be displayed normally. If the measured value is larger than the upper alarm limit, the background will become green; and if the measured value is smaller than the lower alarm limit, the background will become blue.

1.3.1 Receiver Setting

When the demodulation meter window is opened, the receiver setting window will pop up at the same time. Select the receiver setting window, and the [Receiver Setting] menu will pop up, including [Demodulation Type], [Input Port], [Frequency], [Reference], [IF bandwidth], [Audio Filter], [Center Frequency Step] and [Search Mode]. See 1.2.1 of this chapter for the menu structure.

1.4. Audio Source

Press the [Measurement] hard key, select the audio source in the screen, click "OK" and select the audio source window. The [Audio Source] menu will pop up, including [Audio Source 1], [Audio Source 2], [Noise Source], [Step Setting], [Source Selection], [Output Port] and [Volume]. They can be selected and set in the window or menu. The menu structure is as follows.

AudioGen	Generator1	Noise	StepSet	Prot
Generator1 ›	Generator1 Off On	Noise Off On	FreqStep 1 kHz	⊙ AudioOut
Generator2 ›	Freq 1 kHz	Ampl 1 Vp	AudioAmpl 0.01 Vrms	◯ Set+Out
Noise ›	Ampl 1 Vrms		NoiseAmpl 0.01 Vp	
		‹ Return		Volume 50 %
StepSet ›				
Source Internal ›	‹ Return		‹ Return	
Port AudioOut ›				‹ Return
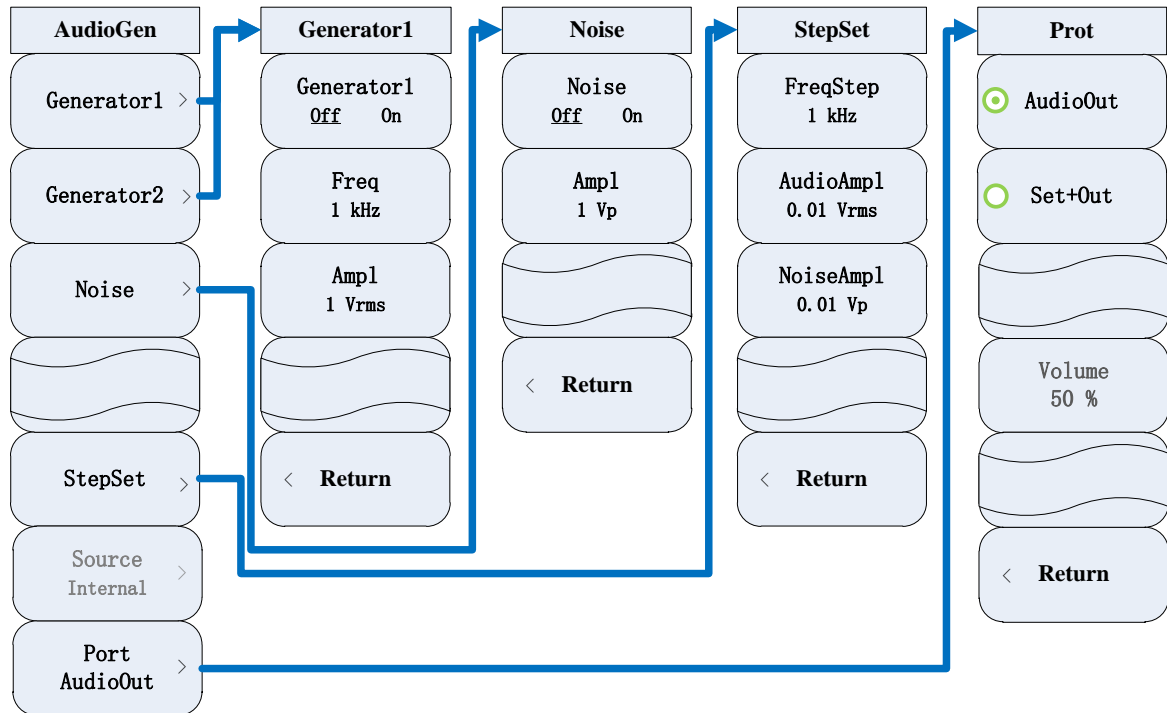
Fig. 5-7 [Audio Source] Menu

[Audio source 1]

Include the ON/OFF state, frequency and amplitude setting of Audio Source 1. The frequency or amplitude can be adjusted with the number keys, step keys or knob.

[Audio source 2]

Include the ON/OFF state, frequency and amplitude setting of Audio Source 2. The frequency or amplitude can be adjusted with the number keys, step keys or knob.

[Noise Source]

Include the ON/OFF status and amplitude setting of the noise source. The amplitude can be adjusted with the number keys, step keys or knob.

[Source Selection]

Display the source type. The default setting is the internal audio. The setting is not optional.

[Output port]

Select the output port: [Audio Output] and [Device+Output].

1.5 Audio meter

Press the [Measurement] hard key, select the audio meter in the screen, click "OK", and open and select the audio meter window. The [Audio Meter] menu will pop up, including [Average OFF

ON], [Averaging Times], [Distortion Type], [Voltage Unit], [Alarm Setting], [Impedance], [Range] and [Zero Calibration]. The menu structure is as follows.
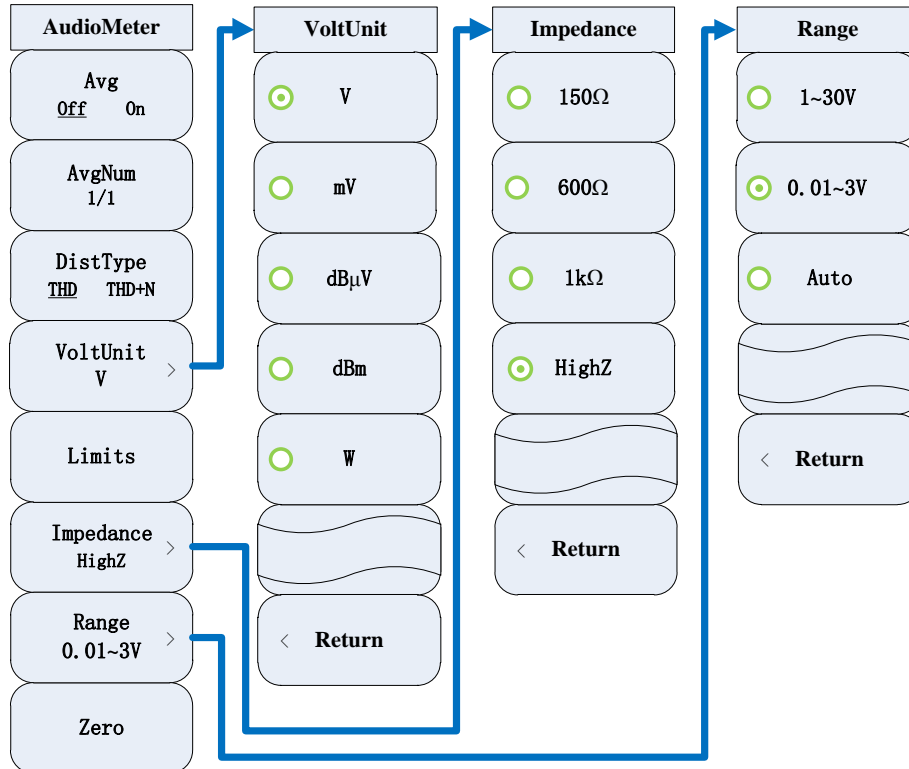
Fig. 5-8 [Audio Meter] Menu
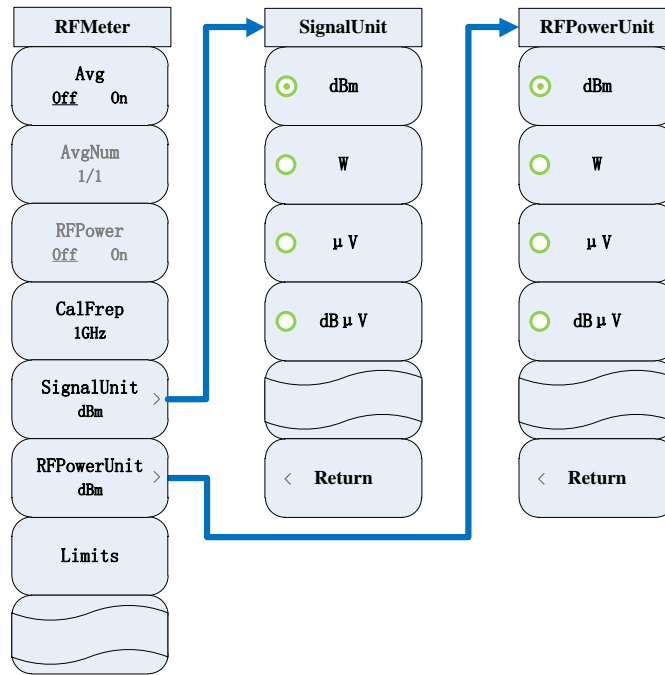
[Average OFF ON]

Enable or disable the function of continuously averaging the frequency values.

[average frequency]

Set up average frequency.

[Distortion type]

Select the distortion type: THD or THD+N. The default type is THD.

[Voltage unit]

Set the voltage display unit: [V], [mV], [dBμV], [dBm] or [W]. The default unit is V.

[Alarm device]

Set the alarm value. The measured value within the set alarm limit will be displayed normally. If the measured value is larger than the upper alarm limit, the background will become green; and if the measured value is smaller than the lower alarm limit, the background will become blue.

[Impedance]

Set the input impedance of the audio meter: [150Ω], [600Ω], [1kΩ] or [High Impedance]. The default setting is high impedance.

[Range]

Set the range of the audio meter: [1-30V], [0.01-3V] or [Auto]. The default range is 0.01-3V.

[Zero correction]

Calibration the zero position of the audio meter.

1.6 Digital Voltmeter

Press the [Measurement] hard key, select the digital voltmeter in the screen, click "OK", and open and select the digital voltmeter window. The [Digital Voltmeter] menu will pop up, including [Measurement Mode], [Range Selection], [Unit], [Resolution], [Average OFF ON], [Averaging Times] and [Zero Calibration]. The menu structure is as follows.
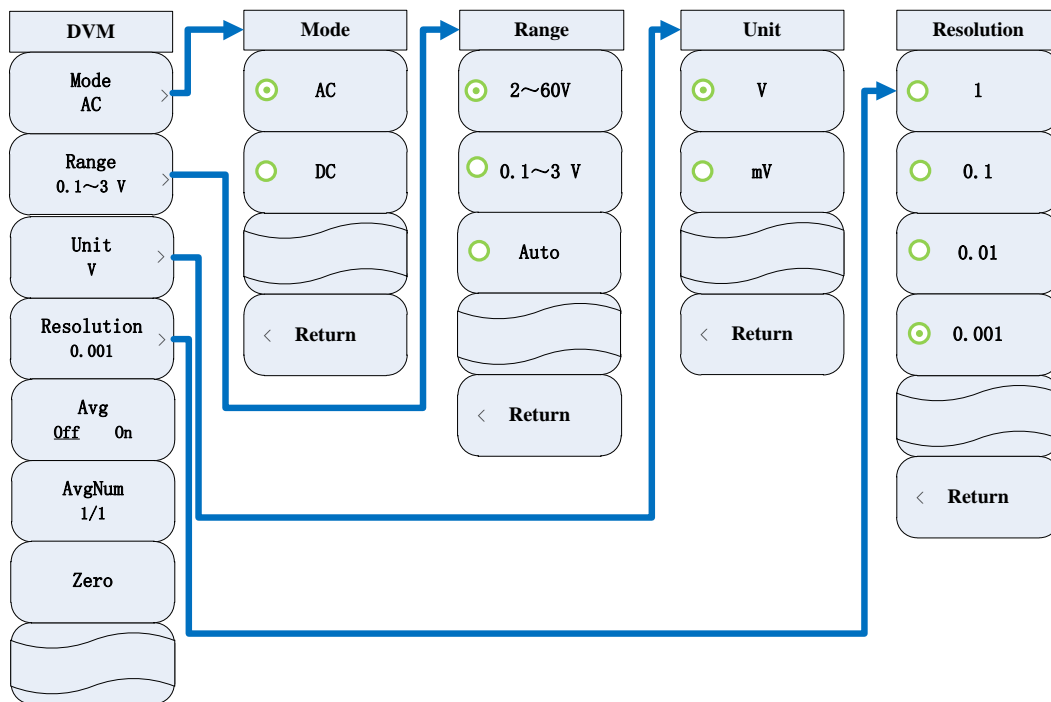
Fig. 5-9 [Digital Voltmeter] Menu

[Measurement mode]

Select the measurement mode: AC or DC.

[Range option]

Select the range: 2-60V or 0.1-3V.

[Unit]

Select the display unit: [V], [mV], [dBuV], [dBm] or [W]. The default unit is V.

[Resolution]

Select the display resolution: [1], [0.1], [0.01] or [0.001]. The default resolution is 0.001.

[Average OFF　ON]

Enable or disable the function of averaging the measured values.

[Average frequency]

Set up average frequency.

[Zero correction]

Calibration the zero position of the audio meter.

1.7 Cable Tester

Press the [Measurement] hard key, select the cable tester in the screen, click "OK", and open and select the cable tester window. The [Cable Test] menu will pop up, including [Frequency Setting], [Test Type], [Cursor], [Display Setting], [Display Mode Refresh　Hold], [DTF Test] and [Calibration]. The menu structure is as follows.

AntCable	FreqSet	Type	Markers
FreqSet	Center 501 MHz	⊙ SWR	Marker 1 2 3
Type SWR >	Span 998 MHz	○ DTF	Switch Off On
Markers >	Start 2 MHz	○ RL	Mode Normal Delta
DisplaySet >	Stop 1 GHz	○ LOSS	SetPos
DisplayMode Resume Hold			Peak
DTFTest >	‹ Return	‹ Return	LeftPeak
Calibration >			RightPeak
			‹ Return

Calibration	DTFTest	DisplaySet
Start	Cable User	Top 7
Open	Velocity 1	Bottom 1
Short	Loss 0 dB/m	Auto
Load	EstLength 24.048 m	
Done		‹ Return
‹ Return	‹ Return	

Fig. 5-10 [Cable Test] Menu

[Frequency setting]

The [Frequency Setting] soft menu will pop up, including [Center Frequency], [Sweep Width], [Starting Frequency] and [Stop Frequency]. The frequency can be adjusted with the number keys, step keys or knob.

[Test type]

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The [Cable Test Type] soft menu will pop up, including [SWR], [DTF], [RL] and [LOSS].

[Test Type] →[SWR]

Select the voltage SWR test as the test type.

[Test Type] →[DTF]

Select the DTF test as the test type.

[Test Type] →[RL]

Select the return loss test as the test type.

[Test Type] →[LOSS]

Select the cable loss test as the test type.

[Cursor]

The cursor-related soft menu will pop up. For details, refer to the [Spectrum Analyzer]→[Cursor] requirements of Section 1.9 of this chapter.

[Display setting]

Set the display range of the vertical axis, including [Top Value of Vertical Axis], [Bottom Value of Vertical Axis] and [Automatic Setting]. If [Automatic Setting] is selected, the top value and bottom value of the vertical axis will be set automatically according to the actual range, so as to achieve the best display effects.

[Display mode Refresh   Hold]

Change the trace display into the Refresh or Hold mode. In the Refresh mode, all the trace data displayed previously will be refreshed and continuously displayed as the signal received in the scanning status. In the Hold mode, the trace amplitude data will be kept and displayed and not be updated in scanning.

[DTF Test]

The soft menu related to the DTF test will pop up, including [Cable Type], [Relative Velocity], [Unit Loss] and [Estimated Length].

[DTF test] → [Cable type]

Select the cable type. The default cable type is User.

[DTF test] → [Relative velocity]

Set the relative transmission velocity of the cable.

[DTF test] → [Unit loss]

Set the unit loss of the cable.

[DTF test] → [Estimated length]

Set the estimated length of the cable.

[Calibration]

The soft menu related to calibration will pop up, including [Start Calibration], [Open Circuit], [Short Circuit], [Matching] and [Complete Calibration].

[Calibration] → [Start calibration]

Perform error correction and start calibration.

[Calibration] → [Open circuit]

Connect the open-circuit device and select the open circuit as the calibration standard.

[Calibration]   → [Short circuit]

Connect the short-circuit device and select the short circuit as the calibration standard.

[Calibration] → [Matching]

Measure the positive and negative matching.

[Calibration] → [Complete calibration]

Save calibration data.

1.8 Oscilloscope (optional)

Press the [Measurement] hard key, select the oscilloscope in the screen, open and select the oscilloscope window, and the [Oscilloscope] menu will pop up, including [Time/Interval], [Amplitude/Interval], [Reference Position], [Trigger], [Cursor] and [Port Setting]. The menu structure is as follows.

Oscillo		Trigger		TriggerMode		Cursors		AudioSet

Oscillo:
- Time/div 2 mS
- Level/div 100 mV
- Position 4
- Trigger ›
- Cursors ›
- AudioSet ›

Trigger:
- Mode Auto
- Edge Rising Falling
- Level 0 V
- TriggerTime 0 nS
- ‹ Return

TriggerMode:
- ⊙ Auto
- ○ Normal
- ○ Single
- ‹ Return

Cursors:
- Cursor A B
- Switch Off On
- Mode Level Time
- ‹ Return

AudioSet:
- ⊙ External
- ○ Demod
- ○ DVM
- ExternalSet › → A
- DemodSet › → B
- DVMSet › → C
- ‹ Return

ExternalSet (A):
- Impedance HighZ ›
- Range 0.01~3V ›
- Zero
- ‹ Return

Impedance:
- ○ 150Ω
- ○ 600Ω
- ○ 1kΩ
- ⊙ HighZ
- ‹ Return

Range:
- ○ 1~30V
- ⊙ 0.01~3V
- ○ Auto
- ‹ Return

DVMSet (C):
- Coupling AC ›
- Range 0.01~3V ›
- Zero
- ‹ Zero

Coupling:
- ⊙ AC
- ○ DC
- ○ GND
- ‹ Return

Range:
- ○ 2~60V
- ⊙ 0.1~3V
- ○ Auto
- ‹ Return

Fig. 5-11 [Oscilloscope] Menu

[Time/Interval]

Set the value of each interval on the horizontal axis. The default value is 2ms.

[Amplitude/Interval]

Set the value of each interval of the vertical axis. The default value is 100mV.

[Reference position]

Set the zero frequency position. The default value is 4.

[Trigger]

The soft menu related to the trigger function will pop up for abnormal signal capturing and circuit

fault debugging, including [Trigger Mode Auto Normal], [Pulse Edge Rising Falling], [Trigger Level] and [Trigger Position].

[Trigger] →[Trigger Mode]

Switch the trigger mode: Auto, Normal and Single. If "Auto" is selected, the sawtooth voltage will be generated automatically by the scanning circuit. No matter whether there is a signal to be tested, the bright scanning line will appears on the oscilloscope screen. If the signal to be tested is sent, the scanning mode of automatic scanning will automatically change into trigger scanning. If "Normal" is selected, i.e. trigger scanning, scanning will be in the ready status in the case of no trigger signal, and there will be no scanning line. If the trigger signal is received, scanning will be triggered. If "Single" is selected, scanning will be stopped after one trigger scanning of the received trigger signal, which is different from that in the normal mode.

[Trigger] →[Pulse Edge   Rising   Falling]

Select the trigger pulse edge as the rising edge or falling edge.

[Trigger] →   [Trigger level]

Set the trigger level, and determine the vertical height of the trigger point.

[Trigger] →[Trigger Time]

Set the trigger time and determine the horizontal position of the trigger point.

[Cursor]

The soft menu related to the oscilloscope cursor will pop up, including [Cursor A   B], [Cursor OFF   ON], [Mode Voltage   Time] and [Position].

[Cursor] →[Cursor A B]

Change the current cursor. Read the voltage and time information of the cursor. Such values are displayed in the cursor display zone in the upper part of the screen. The selected cursor has the following functions: [Cursor OFF   ON], [Mode Voltage   Time], [Position], etc.

[Cursor] →[Cursor OFF   ON]

Enable or disable the selected single active cursor. In the first enabling, the cursor is at the starting position of the waveform. In the voltage mode, the cursor jumps in the vertical position. In the time mode, the cursor jumps in the horizontal position. The voltage or time information can be read in the cursor display area if the cursor is ON. The current active cursor can be moved with the

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knob or step keys or by dragging the touch screen.

[Cursor] →[Mode Amplitude   Time]

Switch the cursor mode into the amplitude or time mode. This key is available when the current cursor is ON. In the amplitude mode, the amplitude of the current cursor position is displayed in the cursor display area of the screen. In the time mode, the time of the current cursor position is displayed in the cursor display area. This cursor can be moved with the knob, step keys or number keys.

[Port setting]

The soft menu related to the signal port will pop up. The signal port type can be selected, including [External Audio], [Demodulation] and [DVM]. The default port is the external audio.

[Port Setting] →[ExternalAudio Setting]

The soft menu related to external audio setting will pop up. The impedance and range can be set. Zero calibration can be done to the oscilloscope. Refer to Section 1.5 of this chapter for setting of [Impedance] and [Range]. Such setting requirements are not repeated here.

[Port Setting] →[Demodulation Setting]

The soft menu related to demodulation setting will pop up. Refer to Section 1.1.1 for specific setting.

[Port Setting] →[DVM Setting]

The soft menu related to DVM setting will pop up, in which the coupling mode and range can be set. Zero calibration can be done to the oscilloscope.

[Port setting] →   [DVM setting] → [Coupling mode]

The coupling mode setting menu will pop up, including AC, DC and GND. The default mode is AC.

[Port Setting] →[DVM Setting] →[Range]

The range setting menu will pop up, including 2-60V and 0.1-3V. The default range is 0.1-3V.

1.9 Spectrum analyzer (optional)

Press the [Measurement] hard key, select the spectrum analyzer in the screen, click "OK" and open and select the spectrum analyzer. The [Spectrum Analyzer] menu will pop up, including

[Center Frequency], [Center Frequency Step], [Sweep Width], [Reference], [Resolution Bandwidth], [Input Port T/R ANT], [Cursor] and [Advanced]. If the spectrum analyzer is ON, the RF meter and demodulation meter will not be available. The menu structure is as follows.

SA		Marker1/2		Marker2/2		Senior		DetectType
Center 500 MHz		Marker 1 2 3 4		LeftPeak		RBWSwitch Manual Auto		⊙ Normal
FreqStep 1 kHz		Switch Off On		RightPeak		SPAN/RBW 100		○ Peak
Span 5 MHz		Mode Normal Delta		Max		Avg Off On		○ NegPeak
RefLevel 0 dBm		SetPos		Min		AvgNum 1/1		○ Avg
RBW 30 kHz		->Center				DetectType Normal		○ Sample
Port T/R ANT		Peak		< Return				○ RMS
Markers >		Next >				< Return		
Senior >		< Return						< Return
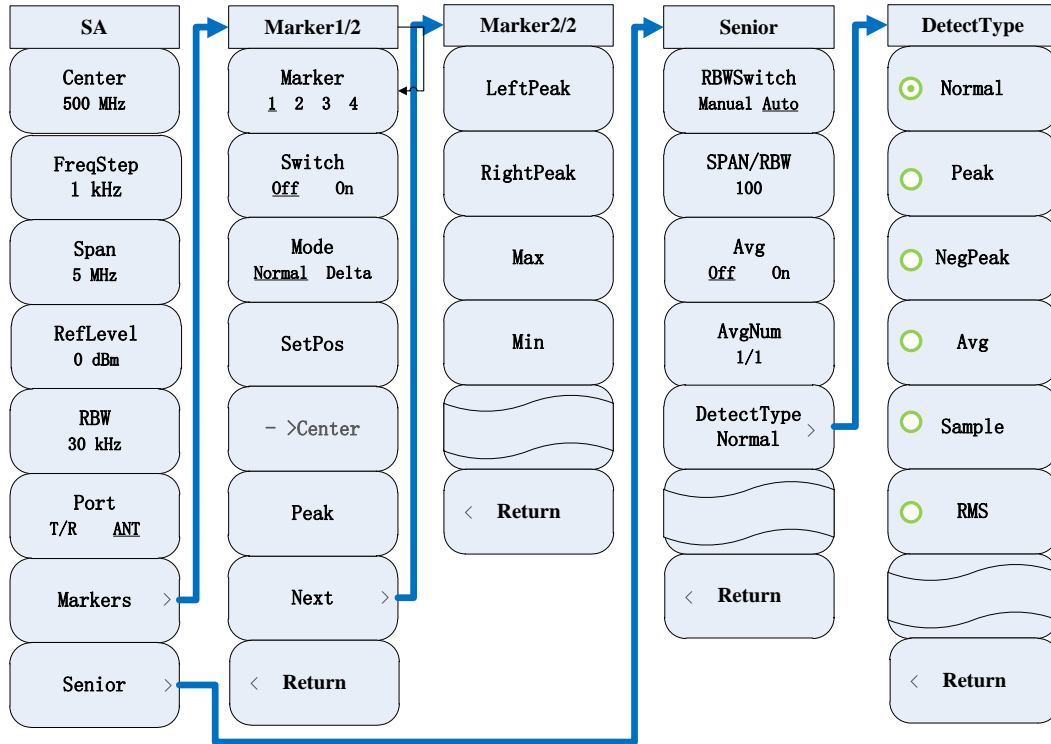
Fig. 5-12 [Spectrum Analyzer] Menu

[Center Freq]

Enable the center frequency. The center frequency can be adjusted with the number keys, step keys or knob. The step keys and knob change according to the step frequency. If the set center frequency is not coordinated with the current sweep width, the sweep width will be automatically adjusted to the best value corresponding to the center frequency.

[Center frequency step]

Set the step of frequency adjustment. The frequency step can be adjusted with the number keys, step keys or knob.

[Sweep Width]

Enable the sweep width function. The sweep width can be adjusted with the number keys, step keys and knob. The step keys and knob change by the step 1, 2 or 5. The default value is 5MHz.

[Reference]

Enable the reference level setting function. The reference level can be adjusted with the number

keys, step keys or knob. The amplitude step is 1dBm. The reference level corresponds to the top value of the coordinate grid. The signal measured at the reference level is the most accurate. The input attenuator is associated with the reference level, and can be adjusted automatically to avoid input signal compression. The default reference level is 0dBm.

[Resolution bandwidth]

Adjust the resolution bandwidth, ranging from 10Hz to 3kHz. The resolution bandwidth can be changed with the number keys, step keys and knob. The step keys and knob change by the step 1, 3 or 10. The default resolution bandwidth is 30kHz.

[Input port T/R   ANT]

Select the T/R port or ANT port as the input port of the spectrum analyzer.

[Cursor]

The soft menu related to the cursor will pop up, including [Cursor 1 2 3 4], [Cursor OFF   ON], [Mode Normal   Differential], [Position], [→Center Frequency], [Peak], [Left Peak], [Right Peak], [Maximum] and [Minimum].

[Cursor] →[Cursor1 2 3 4]

Change the current cursor. The frequency information can be read with the cursor, and the values are displayed in the cursor display area in the upper part of the screen. The selected cursor has the following functions: [Cursor OFF   ON], [Mode Normal   Differential], [Position], [→Center Frequency], [Peak], [Right Peak], [Left Peak], [Maximum], [Minimum], etc.

[Cursor] →[Cursor OFF   ON]

Enable or disable the selected single active cursor. The cursor enabled for the first time will be set in the starting position of the trace. In the differential mode, disable the cursor to exit this mode. If the cursor is ON, the frequency information can be read in the cursor display area. The current active cursor can be moved with the knob or step keys or by dragging the touch screen.

[Cursor] →[Mode Normal   Differential]

Enable the normal or differential mode of the cursor. This key is available when the current cursor is ON. In the normal mode, the frequency of the current cursor position is displayed in the cursor display area in the upper part of the screen. In the differential mode, the frequency difference between the differential cursor and normal cursor is displayed in the cursor display area. When the

differential mode is ON, a reference cursor will be generated in the position of the active cursor. The frequency difference displayed by the reference cursor is the frequency difference between the reference cursor and corresponding normal cursor. The initial cursor and normal cursor are overlapped. The reference cursor can be moved with the knob or step keys or by dragging the touch screen.

[Cursor]　→ [Position]

Set the frequency, and place the cursor at the set frequency point.

[Cursor] →➔[Center frequency]

Set the current frequency point with the cursor as the center frequency.

[Cursor] →[Peak]

Place one cursor at the maximum peak point of the trace. The frequency and amplitude of this cursor are displayed in the upper right corner of the screen. The current active functions are not affected by this key.

[Cursor]→ [Left peak]

Search next peak on the left side of the current cursor position.

[Cursor]→ [Right peak]

Search next peak on the right side of the current cursor position.

[Cursor]→ [Maximum]

Search the maximum value of the current trace.

[Cursor] →[Minimum]

Search the minimum value of the current trace.

[Advanced]

Include [Bandwidth Setting Manual　Auto], [SPAN/RBW], [Average OFF　ON] and [Averaging Times].

[Advanced] →[Bandwidth Setting Manual　Auto]

Adjust the resolution bandwidth mode. In the manual mode, the resolution bandwidth can be changed with the number keys, step keys or knob. The step keys and knob change by the step 1, 3 and 10. In the auto mode, the resolution bandwidth changes along with the sweep width according to the SPAN/RBW proportion.

[Advanced]→[SPAN/RBW]

Set the SPAN/RBW proportion.

[Advanced] →[Average OFF　ON]

Enable or disable the function of continuously averaging the frequency values.

[Advanced]→ [Averaging number]

Set up average frequency.

[Advanced]→ [Detection type]

Set the detection type: [Normal], [Positive Peak], [Negative Peak], [Averaging], [Sampling] and [Root Mean Square]. The default detection type is [Normal].

2. Transmitter

[Transmitter]

The window related to RF transmitter testing will pop up, including four functional windows: "RF Meter", "Receiver Setting", "Demodulation Meter" and "Audio Source". For specific settings of corresponding menus, refer to Section 1.2, 1.2.1, 1.3 and 1.4 of this chapter.

3 Receipt

[Receiver]

The window related to RF receiver testing will pop up, including three functional windows: "RF Source", "Modulation Source' and "Audio Meter". For specific settings of corresponding menus, refer to Section 1.1, 1.1.1 and 1.5 of this chapter.

4 Audio

[Audio]

The test instrument window related to audio will pop up, including two functional windows: "Audio Source" and "Audio Meter". For specific settings of corresponding menus, refer to Section 1.4 and 1.5 of this chapter.

5 Cable

[Cable]

The cable tester function window will pop up. For specific settings of corresponding menus, refer to Section 1.7 of this chapter.

6 Call

[Call]

The test instrument window related to audio will pop up, including four functional windows: "RF Source", "Modulation Source", "Demodulation Meter" and "Receiver Setting". For specific settings of corresponding menus, refer to Section 1.1, 1.1.1, 1.3 and 1.2.1 of this chapter.

7 Memory/call

Press [File], and the menu of file saving and calling function will pop up, including the saving status and calling status. The menu structure is as follows.
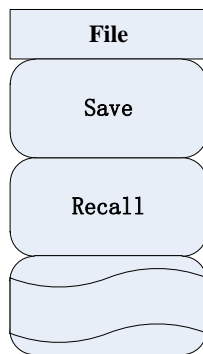
Fig. 5-13[File] Menu

[Saving status]

Save relevant test settings of the test instrument, such as the frequency setting. When this key is pressed, the file name dialog box will pop up. In this case, you can enter the file name with the number keys and press [OK] to complete the status saving.

[Call status]

Call the measurement setting of the integrated test instrument, and set this instrument into the saving status. When this key is pressed, the status list dialog box will pop up. You can select the status to be called with the UP/DOWN key or knob and press [OK] to complete the status calling.

8. System

Press [System], and the system menu will pop up. This system menu is mainly applied to set system parameters and display the system information, including the device information display, message recording, data setting, GPS ON/OFF, etc. The menu structure is as follows.
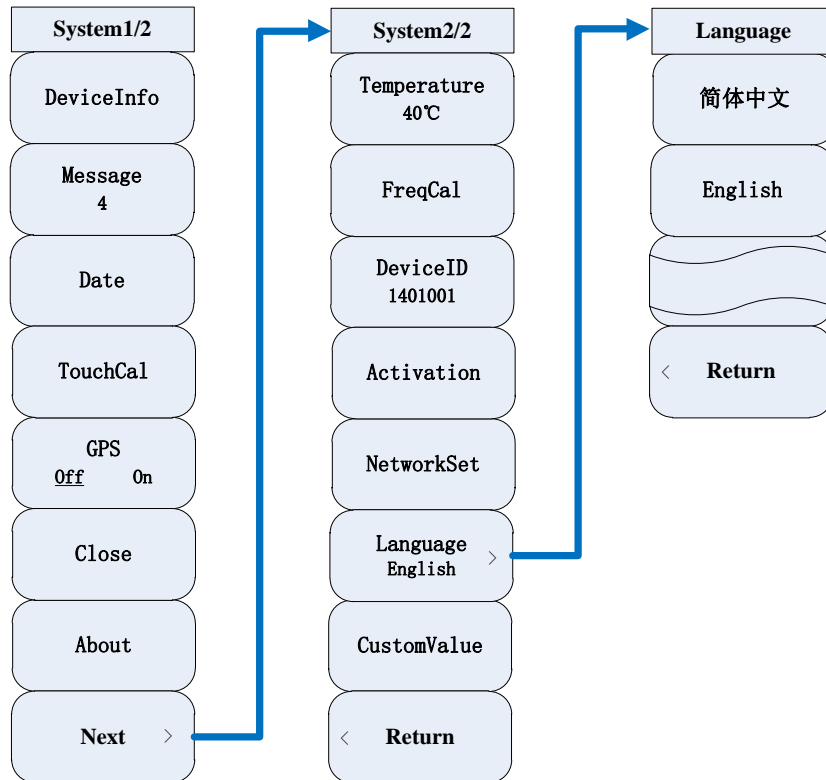
Fig. 5-14[System] Menu

[Equipment parameters]

Display the device information, including the model, serial number, application program version, CPLD version, FPGA version and operating system version. You can exit the display interface with the [OK] or [Cancel] key.

[Message record]

Display the prompt or error information records. You can exit the display interface with the [OK] or [Cancel] key.

[Date setting]

Set the date and time of this instrument. After the date setting menu is enabled, one table including the year, month, date, hour and minute information will be displayed on the screen. If "Year", "Month", "Date", "Hour" or "Minute" is selected as the cursor focus, the background color of the corresponding number in the table will become blue, indicating that the editing status is enabled. The date can be modified with the number keys, UP/DOWN key and knob.

[Touch Pad Calibrate]

Call the calibration program on the system screen and calibrate the screen according to the

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prompts on the screen.

[GPS OFF　ON]

Enable or disable the GPS positioning function.

[Measurement OFF]

Close the windows of all measurement functions.

[About]

The "About" window will pop up.

[Internal temperature]

Display the internal temperature of the instrument.

[LO frequency calibration]

The LO frequency calibration window will pop up.

[Device ID]

Display the serial number of the instrument.

[Option activation]

The input option activation code window will pop up.

[Internet Setting]

The network setting window will pop up.

[System language]

The system language setting window will pop up: [Simplified Chinese] and [English]. The default

setting is [Simplified Chinese].

Article II Technical Specifications

Chapter VI Operating Principle

The tester is comprehensively integrated with various functions such as RF signal source, RF power measurement, received signal strength indication (RSSI), RF frequency error measurement, AM modulation/FM frequency deviation measurement, audio signal generator, base-band modulation/demodulation device, audio SINAD measurement, audio distortion measurement, audio frequency measurement, RF standing wave ratio measurement, etc., thus realizing rapid testing of comprehensive parameters of the radio.

The design idea is with the built-in radio processing unit, the digital signal processing platform and software are fully applied to define the radio technology, and the capability of automatic testing of comprehensive parameters is realized in combination with the integration of RF transmitter/receiver modules and other multi-function components. The block diagram of system functions of the Radio Test Set are shown in Fig. 6-1.
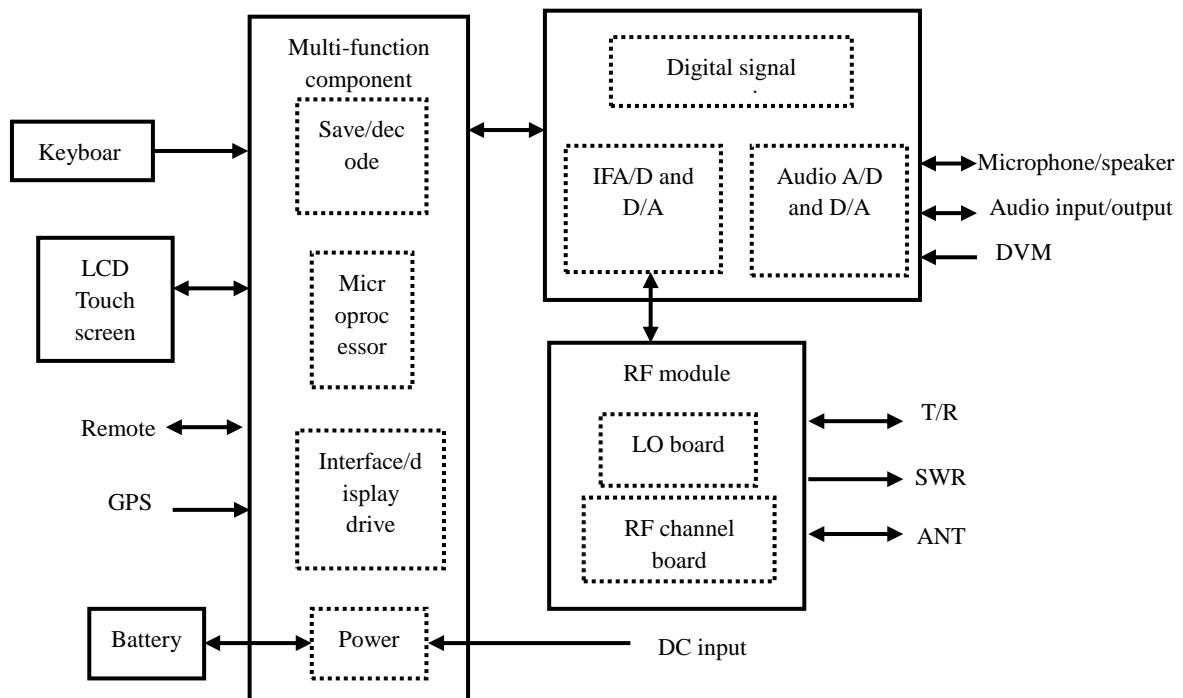
Fig. 6-1Block Diagram of System Functions

System hardware can be divided into the RF module, low-frequency and digital processing module, multi-function component, display, touch screen keyboard, battery, etc.

The RF module includes the RF channel processing and LO part. The RF channel is applied for processing of RF transmitter and receiver channels. The LOC part includes the overall standard-frequency, variable-frequency LO and Source 2 RF signal generation circuit.

The low-frequency and digital processing module includes the digital signal processing circuit, IF processing circuit and audio processing circuit, for digital-analog conversion and analysis of IF and audio signals.

Multi-function components include the microprocessor, memory, decoding circuit,

interface/display drive and relevant power circuits. On one hand, the overall control can be coordinated. On the other hand, battery charging can be managed and the overall power supply can be provided.

Specifically, the full duplex connection between the tested radio and instrument can be realized by the RF module. At the same time, the IF signal can be transferred to the IF processing unit. The hardware basis of integrated test formed by the RF module, digital signal processing platform and microprocessor. The following functions can be realized: real-time RF frequency error measurement, IF modulation/demodulation, received signal strength measurement, etc. The real-time spectrum analysis can be done for transmitter signals to complete the comprehensive measurements of most of performance indicators of the radio. The audio signal generator is used for providing audio signals for the radio test, and the audio analysis module is used for testing the audio distortion, audio SINAD and audio frequency. The output can be displayed on the oscilloscope.

Chapter VII Performance Feature Test

State ment: The specific operating steps for the testing of each indicator are prepared as per the testing instruments shown in the figure; when other testing instruments with similar performance characteristics are used, the operating steps should be decided with reference to the user manual of such instruments. The reset instrument mentioned in the testing steps is in manufacturer reset mode; if the equipment is in user defining reset state, it should be changed to manufacturer reset state and reset is done one more to ensure the equipment is in a known initial state.

Table 7-1 Recommended Devices for 4992A Radio Test Set

S/N	Instrument name	Main technical indexes	Recommended cable
1	Synthetic signal source	Frequency range: 250kHz~6000MHz Power output: -120dBm to +20dBm	E4438C
2	Solid-state amplifier	Frequency range: 800MHz~3000MHz Small signal open-loop gain:50dB Saturated output power: 48dBm	38701E
3	Function generator		Agilent 33250A
4	Standard audio distortion source	Frequency range: 20Hz~20kHz Distortion:0.01% to 100%	ZN5541
5	spectrum analyzer	Frequency range: 3Hz~26.5GHz	Agilent E4440A or 4036
6	Power meter host	Power range: Calibrated in dBm. The relative reference power is -70dBm to +20dBm.	HP437B or 2432
7	Power probe	Frequency range of power sensor: 50MHz to 18GHz Power sensor SWR: 1.15 (50MHz to 100MHz) 1.10 (100MHz to 2GHz)	Sensor: HP8485A And HP8487D or 23211, 23211E
8	Audio analyzer	Frequency range: 20Hz~100kHz Output amplitude: 0.1mV to 10V	VA-2230A Agilent 8903A

9	Measurement receiver and sensor	Frequency range: 250kHz~1300MHz
		Power range: -127dBm to +17dBm
		Power linearity: $\pm$0.1dB/10dB (-20dBm to +20dBm)
		Amplitude modulation velocity: 20Hz to 100kHz
		        Depth: (0-90)%
		        Accuracy: $\pm$2% (1kHz)
		Frequency modulation velocity: 20Hz to 200kHz
			3923
			87104
			
			FSMR50
			NRP-Z37
			
			HP8902A
			HP11722A

		Frequency deviation: 0kHz to 400kHz Accuracy: ±3% (1kHz)	
10	microwave frequency meter	Frequency range: 500kHz~20GHz	Agilent 5350B
11	Ruler		
12	Balancer		
The tester of the same performance characteristics can be used as a substitute.			

1. Frequency range of RF source

a) Test items
The frequency range refers to the frequency range of the signal which is provided by the signal source and conforms to the specifications. It is generally described with the upper and lower limit. The output frequency range of the RF signal source 1 is 2MHz to 1000MHz, and the output frequency range of the RF source 2 is 2MHz to 400MHz. As the time base cannot be commonly used by the instrument and external device, test requires should meet the requirements within ±2ppm, in combination of various influencing factors.
b) Test block diagram and meters

```
                        RF input              ANT output
    ┌──────────────────────┐          ┌──────────────────────┐
    │   Agilent 5350B      │          │       4992A          │
    │   Frequency meter    │          │   Rradio Test Set    │
    └──────────────────────┘          └──────────────────────┘
```
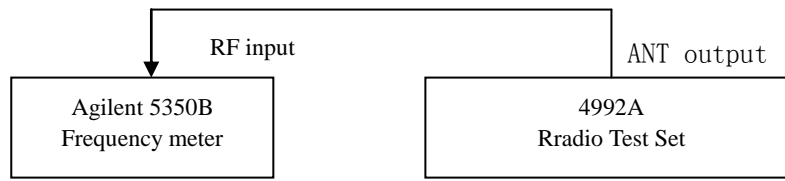
Fig. 7-1 Block Diagram of Frequency Range and Resolution Test of RF Source

Instrument / equipment:

Frequency meter(recommended model: Agilent 5350B)

One N/BNCadapter

One RF cable (80cm)
c) Test steps
1) Connect the test instrument as shown in the figure, and warm it up for 30min.
2) Open the RF source window by pressing the [Receiver] hard key or pressing the [Measurement] key and setting the instrument menu. Set it as follows:

Output port: ANT

RF Source 1Power: -5dBm

RF Source 1: ON

The modulation window must not be opened.
3) Set the frequency of RF Source 1 within its frequency range, and record the reading of the microwave frequency meter in Table A.2.
4) Change the output source into RF Source 2, and set the output port and power like RF Source 1.
5) Set the frequency of RF Source 2 within its frequency range, and record the reading of the microwave frequency meter in Table A.2.

2. Output power range and accuracy of RF source

a) Test items
The output power range refers to the dynamic range of the actual output power of the signal

source, and the output power accuracy refers to the difference between the actual output power and set value of the signal source.

The output power range and accuracy of the signal source of this instrument are shown in the following table.

Table 7-2 Output Power Range and Accuracy of Signal Source

Test Port		Range of output power	Accuracy
RF source 1	SWR	-5dBm ~ -65dBm	±2dB
	T/R	-50dBm ~ -125dBm	-50dBm ~ -100dBm, ±2dB -100dBm ~ -125dBm, ±5dB
	ANT	-5dBm ~ -100dBm	±2dB
RF source 2	ANT	0dBm ~ -100dBm	±2dB

b) Test block diagram and meters

Instrument / equipment:

Receiver (recommended model: 3923 and FSMR50)

Sensor(recommended model: 8710 and NRP-Z37)

One N/BNCadapter

One RF cable (80cm)
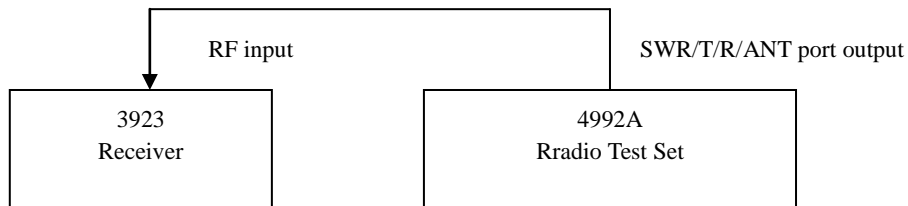
Fig. 7-2 Block Diagram of Output Power Range, Accuracy, Spectrum Purity and Modulation Test of RF Source

c) Test steps

1) As shown in the figure, connect the test instrument, turn on it and warm it up for 30min.

2) Set the receiver into the RF turning level measurement mode, and connect the sensor of the receiver to the SWR port of the tested device.

3) Open the RF source window by pressing the [Receiver] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Output port: SWR

RF Source 1: ON

The modulation window must not be opened.

4) Set the signal frequency and power of RF Source 1 of the test instrument according to Table A.3, and record the test result into the corresponding part of Table A.3.

5) Connect the sensor of the receiver to the T/R port of the instrument, and change the output port of RF Source 1 into the T/R port.

6) Set the signal frequency and power of RF Source 1 of the test instrument according to Table A.3, and record the test result into the corresponding part of Table A.3.

7) Connect the sensor of the receiver to the ANT port of the instrument, and change the output port of RF Source 1 into the ANT port.

8) Set the signal frequency and power of RF Source 1 of the test instrument according to Table A.3, and record the test result into the corresponding part of Table A.3.

9) Close the output of RF Source 1, and open RS Source 2.

10) Set the signal frequency, power and output port of RF Source 2 of the test instrument according to Table A.3, and record the test result into the corresponding part of Table A.3.

3. SSB (single sideband) phase noise of RF source

a) Test items

The phase noise refers to the continuous spectrum sideband generated by the accompanying noise to phase modulation of the carrier signal. It is expressed as the ratio of the SSB noise power within the unit bandwidth at the deviation from the carrier frequency to the carrier power.

Phase noise of the signal source of this instrument: ≤-95dBc/Hz (frequency deviation: 20kHz)

b) Test block diagram and meters

The same output power range and accuracy test.

c) Test steps

1) As shown in the figure, connect the test instrument, turn on it and warm it up for 30min.

2) Open the RF source window by pressing the [Receiver] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set RF Source 1 as follows.

Port: ANT

Frequency: 1000MHz;

Power: -5 dBm

RF Source 1: ON

3) Set the spectrum analyzer as follows.

Center frequency: 1000MHz

Sweep width: 50kHz

Reference level: 0dBm.

4) Test the SSB phase noise at the deviation of 20kHz according to the standard frequency, and record the test result into Table A.4.

5) Close RF Source 1 of the test instrument, and set RF Source 2 as follows.

Port: ANT

Frequency: 400MHz;

Power: -5 dBm

RF Source 2: ON

6) Change the center frequency of the spectrum analyzer into 400MHz, and record the test result of SSB phase noise of RF Source 2 into Table A.4.

4. Parasitic harmonics of RF source

a) Test items

Harmonics is generated arsing from nonlinear signal distortion, and the harmonic frequency is integer times of the signal carrier frequency.

Harmonics of the signal source of this instrument: ≤-30dBc.

b) Test block diagram and meters

The same output power range and accuracy test.

c) Test steps

1) As shown in the figure, connect the test instrument, turn on it and warm it up for 30min.

2) Open the RF source window by pressing the [Receiver] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Port: SWR

RF Source 1 Power: -5dBm

RF Source 1: ON

Set the output frequency of RF Source 1 as 2MHz and 100MHz, and increase it step by step to 100MHz to 1000MHz.

3) According to the output frequency of RF Source 1, properly adjust the center frequency of the spectrum analyzer, measure the parasitic harmonics by the standard frequency and standard frequency difference function, observe and find the point with the poorest harmonics, and record the test result into Table A.5.

4) Change the output port of RF Source 1 into the ANT port. Test the parasitic harmonics of each frequency point, observe and find the points with the poorest harmonics, and record the test result into Table A.5.

5) Close the output of RF Source 1 and perform the following setting.

Port: ANT

RF Source 2 Power: -5dBm

RF Source 2: ON

Set the output frequency of RF Source 2 as 2MHz and 100MHz, and increase it step by step to 100MHz to 400MHz.

6) According to the output frequency of RF Source 2, properly adjust the center frequency of the spectrum analyzer, measure the parasitic harmonics by the standard frequency and standard frequency difference function, observe and find the point with the poorest harmonics, and record the test result into Table A.5.

5. Non-parasitic harmonics of RF source

a) Test items

Non-harmonics refers to the unwanted parasitic or residual signal generated by the frequency synthesis part. It is a kind of fixed signal output or signal output of certain frequency deviation. Set the signal generator as a series of output frequency points at which non-harmonics is easily generated. Tune the spectrum analyzer to the appropriate parasitic signal, and measure and find the point with the poorest non-harmonics.

Non-harmonics of the signal source of this instrument: ≤-35dBc (frequency deviation: more than 20kHz)

b) Test block diagram and meters

The same output power range and accuracy test.

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Open the RF source window by pressing the [Receiver] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Port: SWR

RF Source 1Power: -5dBm

Frequency of RF Source 1: 2MHz

RF Source 1: ON

3) Set the spectrum analyzer as follows.

starting frequency: 0Hz

ending frequency: 1.5GHz

Reference level: 0dBm

4) Measure non-parasitic harmonics by the standard frequency and standard frequency difference function. Change the output frequency of RF Source 1 into 99MHz, and increase it step by step to 100-999MHz. Observe it with the spectrum analyzer, find the point with the poorest non-harmonics, and record test results into Table A.6.

5) Change the output port of RF Source 1 of the test instrument into ANT. Repeat the above test, and record the test result into Table A.6.

6) Close the output of RF Source 1 and perform the following setting.

Port: ANT

RF Source 2 Power: -5dBm

RF Source 2: ON

Set the output frequency of RF Source 2 as 2MHz and 99MHz, and increase it step by step to 100-399MHz.

7) Change the frequency range of the spectrum analyzer into 0Hz to 500MHz. Measure non-parasitic harmonics by the standard frequency and standard frequency difference function, observe and find the point with the poorest non-harmonics, and record the test result into Table A.6.

6. Accuracy of internal amplitude modulation of RF Source 1

a) Test items

The receiver is applied in the following steps to measure the accuracy of linear amplitude modulation of RF signal source 1.

Amplitude modulation accuracy of the signal source of this instrument:$\pm$ (5% $\times$ modulation depth+2%) (150Hz-5kHz modulation rate, 10%-90% modulation depth).

b) Test block diagram and meters

The same output power range and accuracy test.

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Connect the power sensor of the measuring receiver to the RF output port (ANT) of the instrument.

3) Open the RF source window by pressing the [Receiver] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Port: ANT

Frequency of RF Source 1: 500MHz

RF Source 1Power: -15dBm

RF Source 1: ON

4) Open the modulation source window, and set it as follows.

Carrier: RF Source 1

Modulation source: internal audio

Modulation type: AM

Internal Audio Source 1: ON

5) Set the measurement mode of the measuring receiver into the amplitude modulation/demodulation mode, the detector into the average peak mode and the filter as 50Hz HP and 15kHz LP.

6) Set the modulation rate and amplitude modulation depth of the test instrument according to Table A.7, and record the test result of the measuring receiver in Table A.7.

7. Internal frequency modulation accuracy of RF Source 1

a) Test items

The receiver is applied in the following steps to measure the accuracy of internal linear frequency modulation of RF signal source 1.

Accuracy of internal linear frequency modulation of the signal source:±5% (10kHz-100kHz frequency deviation, 150Hz-5kHz modulation rate)

b) Test block diagram and meters

The same output power range and accuracy test.

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Connect the power sensor of the measuring receiver to the RF output port (ANT) of the instrument.

3) Open the RF source window by pressing the [Receiver] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Port: ANT

Frequency of RF Source 1: 500MHz

RF Source 1Power: -15dBm

RF Source 1: ON

4) Open the modulation source window, and set it as follows.

Carrier: RF Source 1

Modulation source: internal audio

Modulation type: FM

Internal Audio Source 1: ON

Modulation rate: 150Hz

Frequency modulation deviation: 100kHz

5) Set the measurement mode of the measuring receiver into the frequency modulation/demodulation mode, the detector into the average peak mode and the filter as 50Hz HP and 15kHz LP.

6) Set the modulation rate and frequency modulation deviation of the test instrument according to A.8, properly change the filter setting, and record the test result of the measuring receiver in Table A.8.

8. Frequency range and accuracy of audio source

a) Test items

The audio analyzer is applied in the following steps to measure the frequency range and accuracy

of the output signal of the audio source. The frequency range of this instrument is 20Hz to ±20kHz, and the accuracy is ±2Hz.

b) Test block diagram and meters

```
                    ┌──────────────────────────┐
                    │                          │
            Audioinput │                      │ Audio output
                    ▼                          │
    ┌───────────────────────┐      ┌───────────────────────┐
    │                       │      │        4992A          │
    │    Audio analyzer     │      │    Rradio Test Set    │
    │                       │      │                       │
    └───────────────────────┘      └───────────────────────┘
```
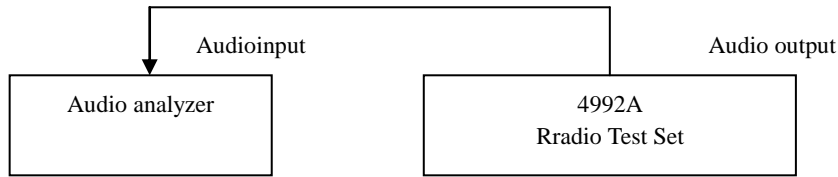
Fig. 7-3 Connection Diagram of Audio Source Test

Instrument / equipment:

Audio analyzer (recommended model: VA-2230A and Agilent 8903A)

One BNC cable (100cm)

c) Test steps

1) As shown in the figure, connect the device, start it and warm it up for 30min.

2) Open the audio source window by pressing the [Audio] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Output port: audio output

Output source: internal audio

Frequency of Audio Source 1: 20Hz

Amplitude of Audio Source 1: 1Vrms

ON/OFF status of Audio Source 1: ON

3) Set the audio analyzer, and test the frequency of the audio signal. Note that if Model 8903 is applied in measurement of low-frequency signals, set "Band width" as "low"; and if Model VA-2230A is applied, set the measurement speed "SP" as "slow".

4) Set the frequency of Audio Source 1 according to Table A.9, and record the measurement results.

5) Close Audio Source 1 of the test instrument, open the output of Audio Source 2, set the frequency of Audio Source 2 according to Table A.9, and record the measurement results.

9. Level range and accuracy of audio source

a) Test items

The audio analyzer is applied in the following steps to measure the level range and accuracy of the output signal of the audio source. The output level range of the audio signal is 20mVrms to 1.57Vrms, and the accuracy is ±10%±2mV.

b) Test block diagram and meters

The same as the test of the audio output frequency range and accuracy.

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Open the audio source window by pressing the [Audio] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Output port: audio output

Output source: internal audio

Frequency of Audio Source 1: 1000Hz

Amplitude of Audio Source 1: 20mVrms

ON/OFF status of Audio Source 1: ON

3) Set the input impedance of the audio analyzer as high impedance.

4) Read the amplitude value in the amplitude   measurement window of the audio analyzer, and record it in Table A.10.

10. Harmonic distortion of audio source

a) Test items

The audio analyzer is applied in the following steps to measure the harmonic distortion of the output signal of the audio source. The harmonic distortion of the audio signal output of this instrument is less than 3% (1kHz, 1Vrms).

b) Test block diagram and meters

The same as the test of the audio output frequency range and accuracy.

Instrument / equipment:

Audio analyzer (recommended model: VA-2230A)

One BNC cable (100cm)

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Open the audio source window by pressing the [Audio] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Output port: audio output

Output source: internal audio

Frequency of Audio Source 1: 1kHz

Amplitude of Audio Source 1: 1Vrms

ON/OFF status of Audio Source 1: ON

3) Set the input impedance of the audio analyzer VA-2230A as high impedance, and the measurement mode as THD.

4) Observe the test result of harmonic distortion of the audio analyzer, and record it in Table A.11.

11. Dual-tone signal

a) Test items

Two audio signals can be outputted at the same time by the audio source of this instrument. The spectrum analyzer can be applied to measure the capability of the audio source to output the dual-tone signal.

b) Test block diagram and meters
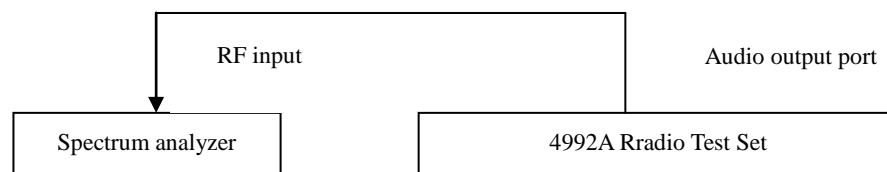
Fig. 7-4 Block Diagram of Dual-tone Output Capability of
Audio Source

Instrument / equipment:

Spectrum analyzer (recommended model: 4033, 4036, etc.)

One N/BNC adapter

One RF cable (80cm)

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Open the audio source window by pressing the [Audio] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Output port: audio output

Output source: internal audio

Frequency of Audio Source 1: 1kHz

Amplitude of Audio Source 1: 0.5Vrms

ON/OFF status of Audio Source 1: ON

Frequency of Audio Source 2: 1.6kHz

Amplitude of Audio Source 2: 0.2Vrms

ON/OFF status of Audio Source 2: ON

3) Set the appropriate starting and stop frequency of the spectrum analyzer, read the frequency of two audio signals, check whether the frequency of the dual-tone signal is correct, and record it in Table A.12.

12. Accuracy of RF power measurement

a) Test items

The ordinary signal source and power amplifier are applied in the following steps to generate high-power test signals. Then the attenuator and power meter are applied for comparison to verify the power measurement characteristics of the instrument. Limited by the existing test conditions, the frequency band of the amplifier is more than 800M. Therefore, only the power of 20dBm can be measured at low frequency.

The RF power measurement port of the instrument is the T/R port, and the measurement accuracy is ±1dB.

In the test process, the power meter should be applied to calibrate the test cable, amplifier and attenuator at first.

b) Test block diagram and meters
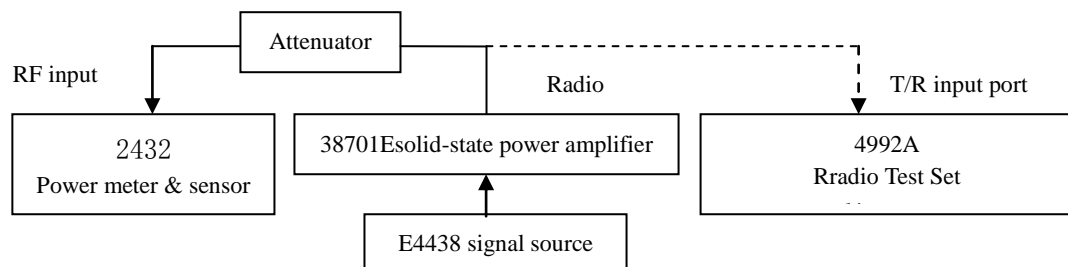
Fig. 7-5 Block Diagram of RF Power Test

Instrument / equipment:

Signal source (recommended model: 1441A, E4438, etc.)

Solid-state power amplifier(recommended model: S41-20, etc.)

Power meter(recommended model: 2432, 2434, etc.)

Power sensor(recommended model: 23211, 71712, N9304, etc.)

Attenuator: two 50W/20dB Attenuators

N/BNCadapter: one

RF cable: two (120cm)

c) Test steps

1) As shown in the figure, start the instrument and warm it up for 30min.

2) Perform zero adjustment and calibration of the power meter and power sensor.

3) Measure the 20dBm signal at first. Directly connect the output of the signal source to the T/R port of the tested device. Set the signal source as follows.

Frequency: 2MHz;

Power: 20 dBm

RF: ON

4) Open the RF meter window by pressing the [Measurement] hard key and setting the instrument menu. Enable the RF power function, and set it as follows.

Display unit: dBm

Average: OFF

Compensation frequency of frequency response: 2MHz, corresponding to the output signal frequency of the amplifier.

Read the RF power test result and record it in Table A.13.

5) Change the output signal frequency of the signal source into 50MHz, 800MHz and 1000MHz according to the table, correspondingly change the frequency of the tested device, read the RF power test result, and record it in Table A.13.

6) Test the 43dBm high-power signal. At first, calibrate the attenuation of the attenuator and cable at 800MHz, connect the output of the signal source to the sensor of the power meter through the test cable and attenuator group. Set the frequency factor of the power meter, and set the signal source as follows.

Frequency: 800MHz;

Power: 0 dBm

RF: ON

Obtain the attenuation of $P_{\Delta\,800M}$ of the cable and attenuator group with the power meter (0-P). The attenuation of $P_{\Delta1000M}$ at

1000MHz can also be obtained in the same method.

7) Obtain the set value of the signal source in the high-power output. Connect the output end of the signal source to the input end of the amplifier, the output end of the amplifier to the attenuator group, and the output end of the attenuator to the sensor of the power meter. Set the signal source as follows.

Frequency: 800MHz;

Power: -30 dBm

RF: OFF

Set the frequency of the power meter as 800MHz. Enable the RF source, open the amplifier output, observe the measured power, and adjust the output power of the signal source, until the displayed value P of the power meter is 43dBm-$P_{\Delta800M}$. Record the set value A_{800M} of the signal source at

this frequency point. Obtain the set value A_{1000M} at 1000MHz in the same method.

Close the RF signal source and amplifier output./

8) Connect the output end of the amplifier to the T/R port of the tested device, and set the signal source as follows.

Frequency: 800MHz;

Power: A_{800M}

RF: OFF

9) Open the RF meter window by pressing the [Measurement] hard key and setting the instrument menu. Enable the RF power function, and set it as follows.

Display unit: dBm

Average: OFF

Compensation frequency of frequency response: 800MHz

Enable the output of the signal source, read the RF power test result, and record it in Table A.13.

10) Change the output of the signal source as follows.

Frequency: 1000MHz;

Power: A_{1000M}

Change the RF power setting of the tested device as follows.

Compensation frequency of frequency response: 1000MHz

Enable the output of the signal source, read the RF power test result, and record it in Table A.13.

13. Accuracy of RF frequency error measurement

a) Test items

The RF output end of the synthetic source is connected to the ANT test port in the following steps. As the common time base interface is not provided, the RF transmitter signal is tested to eliminate the time base error and verify the accuracy of RF frequency measurement results. In order to verify the error measurement range, set the deviation of RF input frequency as ±200kHz to verify the frequency error capturing capability again. The range of frequency error measurement of this instrument is ±200kHz, and the accuracy is ±2Hz (time base error: +2Hz).

b) Test block diagram and meters
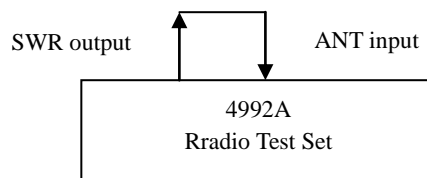
Fig. 7-6 Block Diagram of RF Frequency Error Test

Instrument / equipment:

One BNC cable (30cm)

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Open the RF source window of the tested device by pressing the [Measurement] hard key and setting the instrument menu.

Set it as follows.

Output port: SWR

Frequency of RF Source 1: 500MHz

RF Source 1Power: -10dBm

RF Source 1: ON

3) Open the RF meter window of the tested device by pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Port: ANT

Frequency: 500MHz;

Reference: -10dBm

IF bandwidth: 5kHz

Average: OFF

Record the test result of RF frequency error in Table A.14.

4) Change the power of the signal source according to Table A.14. Then change the reference level of the receiver according to the power of the RF input signal. Record the reading of RF frequency error in Table A.14.

Record the RF frequency error reading in Table A.14.

5) Set the output of the RF source as follows.

Frequency of RF Source 1: 500.2MHz

RF Source 1Power: -10dBm

6) Keep the frequency setting of RF meter, and change the receiver setting as follows.

IF bandwidth: 600kHz

Reference: -10dBm

Average: ON

Average time: 10

Record the RF frequency error reading in Table A.14.

Repeat Step 4), and record the RF frequency error reading in Table A.14.

7) Set the output of the RF source as follows.

Frequency of RF Source 1: 499.8MHz

RF Source 1Power: -10dBm

Repeat Step 6), and record the RF frequency error reading in Table A.14.

14. Accuracy of received signal strength measurement

a) Test items

The output power of the high-accuracy signal source is applied as the benchmark in the following steps to verify the accuracy of the received signal strength test of the ANT and T/R test port. The measurement accuracy of this instrument is ±3dB.

b) Test block diagram and meters
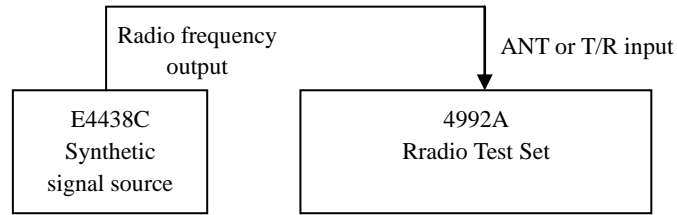
Fig. 7-7 Connection Diagram of Received Signal Strength Test

Instrument / equipment:

Synthetic source(recommended model: E4438C)

N/BNC adapter: one

RF cable: one (80cm)

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Reset E4438C signal source, and set its output as the 2MHz signal and the power as -10dBm. Connect the RF output to the ANT port of RF input of the tested device.

3) Open the RF meter window of the tested device by pressing the [Transmitter] hard key or pressing the [Measurement] hard key and setting the instrument menu.

Set the receiver as follows.

Port: ANT

Frequency: 2MHz;

Reference: 0dBm

IF bandwidth: 600kHz

Properly adjust the output frequency of the signal source to keep the frequency error less than 2.5kHz.

4) Change the receiver setting as follows.

IF bandwidth: 5kHz

Record the reading of the received signal strength in Table A.15.

5) Set the frequency and power output of the signal source in Table A.15. Correspondingly change the receiver setting port, frequency and reference level of the RF meter.

Repeat Step 3) and 4), and record the readings of the received signal strength in Table A.15.

15. Accuracy of AM demodulation measurement

a) Test items

The output signal of E4438 amplitude modulation is applied as the benchmark in the test to verify the accuracy of amplitude modulation measurement of the tested device. The accuracy of the linear amplitude modulation measurement of this instrument is 5%.

b) Test block diagram and meters

The test block diagram and meters are the same as those in RF frequency error measurement.

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Reset E4438C signal source and set it as follows.

Frequency: 500MHz;

Power: -10 dBm

AM modulation: ON

Modulation rate: 1kHz

Modulation depth: 30%

3) Open the demodulation meter of the tested device by pressing the [Transmitter] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set the receiver as follows.

Demodulation type: AM

Port: ANT

Frequency: 500MHz;

Reference level: 0dBm

IF bandwidth: 5kHz

Audio filter: 3kLP

Record the test result of the amplitude modulation depth in Table A.16.

4) Change the modulation depth of the signal source according to Table A.16, and record the reading of the amplitude modulation degree of the tested device in Table A.16.

16. Accuracy of frequency modulation/demodulation measurement

a) Test items

The output signal of E4438 frequency modulation is used as the benchmark to test the accuracy of frequency modulation deviation measurement of the tested device. The accuracy of frequency modulation deviation measurement of this instrument is ±5%.

b) Test block diagram and meters

The test block diagram and meters are the same as those in RF frequency error measurement.

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Reset E4438C signal source and set it as follows.

Frequency: 500MHz;

Power: -10 dBm

FM modulation: ON

Modulation rate: 150Hz

Frequency modulation deviation: 0.5kHz

3) Open the demodulation meter of the tested device by pressing the [Transmitter] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set the receiver as follows.

Demodulation type: FM

Port: ANT

Frequency: 500MHz;

Reference level: 0dBm

IF bandwidth: 5kHz

Audio filter: 3kLP

Record the test result of frequency modulation deviation in Table A.17.

4) Set the frequency modulation parameter of the signal source according to Table A.17, properly

adjust the IF bandwidth of the receiver, and ensure that the IF bandwidth is more than twice of frequency modulation deviation. Then read the test result of frequency modulation deviation and record it in Table A.17.

17. Spectrum analyzer (tested if any)

A.Input frequency range
a) Test items
The output signal of the test signal generator of the frequency meter is applied for comparison to test the frequency range of the received signal of the optional spectrum analyzer. The requirement for this indicator is 2MHz to 1000MHz.
b) Test block diagram and meters

RF output SWR   RF input ANT

4992A
Rradio Test Set
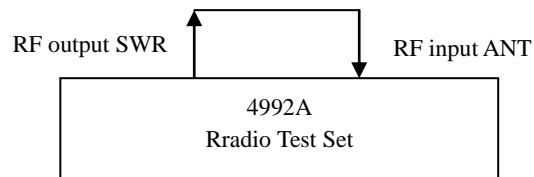
Fig. 7-8 Connection Diagram of Frequency Range Test of Spectrum Analyzer

Instrument / equipment:
BNC cable: one (30cm)
c) Test steps
1) Connect the RF input and output end of the tested device as shown in the figure. Start the instrument and warm it up for 30min.
2) Open the RF source window by pressing the [Transmitter] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.
Port: SWR
Frequency of RF Source 1: 2MHz
RF Source 1Power: -10dBm
RF Source 1: ON
The modulation window must not be opened.
3) Open the spectrum analyzer window by pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.
Port: ANT
Center: 2.005MHz
sweep width: 10kHz
Reference: 0dBm
resolution bandwidth: 30Hz
4) After scanning, read the peak frequency of the signal with the cursor, and record it in the test record table A.18.
5) Change the output frequency of RF Source 1 into 1000MHz. Then change the center frequency of the signal received by the spectrum analyzer into 999.995MHz. Repeat Step 4).
6) If the test frequency error of the tested device is ± (5%×sweep width+25%×resolution bandwidth), the frequency range conforms to the requirement; otherwise, this the frequency

frequency cannot be accepted.

B. Display of average noise level

a) Test items

The display is measured under the conditions of no signal input but 10kHz frequency range of the spectrum analyzer and minimum resolution bandwidth in the test.

Requirements of average noise level:

-110dBm (bandwidth: 10kHz; reference level of receiver: -60dBm)

-130dBm (bandwidth: 10kHz; reference level of receiver: ≤-70dBm)

b) Test block diagram and meters
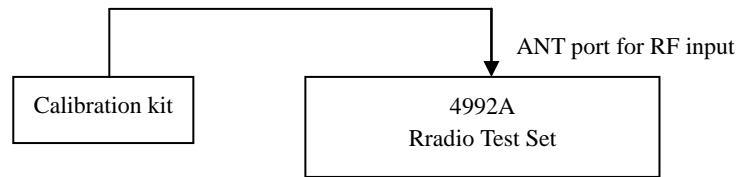
Fig. 7-9 Connection Diagram of Average Noise Level and Residual Response Display Test of Spectrum Analyzer

Instrument / equipment:

N type calibration kit(recommended model: 31101)

N/BNCadapter: one

c) Test steps

1) As shown in the figure, connect the 50Ω load to the ANT port of the tested device.

2) Open the spectrum analyzer window by pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Reference: -60dBm

Center frequency: 3MHz

sweep width: 10kHz

resolution bandwidth: 10Hz

Average: ON

Averaging times:16

3) Set the cursor as the maximum value. Read the level value L of the cursor, record the test result in the test result table A.18, and disable the averaging function.

4) Change the reference level into -80dBm, and enable the averaging function 16 times. After the test results become stable, repeat Step 3) and 4).

5) Set other frequency points according to the test column requirements. Repeat the above test steps, and record the test results in the test record table A.19.

C. Residual response

a) Test items

The inherent parasitic jamming signal of this instrument is measured in this test under the condition of no signal input. The residual response requirement is as follows: ≤-70dBm (reference level of the receiver: -60dBm).

≤-80dBm (reference level of receiver: ≤-70dBm)

b) Test block diagram and meters

The same as the test of the displayed average noise level of the spectrum analyzer.

c) Test steps

1) As shown in the figure, connect the ANT input port of the tested device to the matching load.

2) Open the spectrum analyzer window by pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Port: ANT

Full sweep width

Reference: -40dBm

resolution bandwidth: 3kHz

3) Observe whether there is any residual response signal on the noise baseline of the spectrum analyzer. If there is any residual response signal, read the amplitude of the peak residual response point with the cursor, and record measurement results. If the amplitude of the residual response signal is small, the resolution bandwidth should be further reduced to decrease the displayed average noise level.

4) Change the reference level of the spectrum analyzer into -80dBm. Repeat Step 3), and record the maximum residual response in the test result record table A.20.

D.Input power measurement range

a) Test items

The output signal of the high-accuracy signal generator is used as the benchmark to test the power range of the signal received by the optional spectrum analyzer. The power requirement is as follows: -10dBm to -110dBm (ANT port, 2MHz to 1000MHz)

+43dBm to -50dBm (T/R port, 2MHz to 1000MHz)

b) Test block diagram and meters
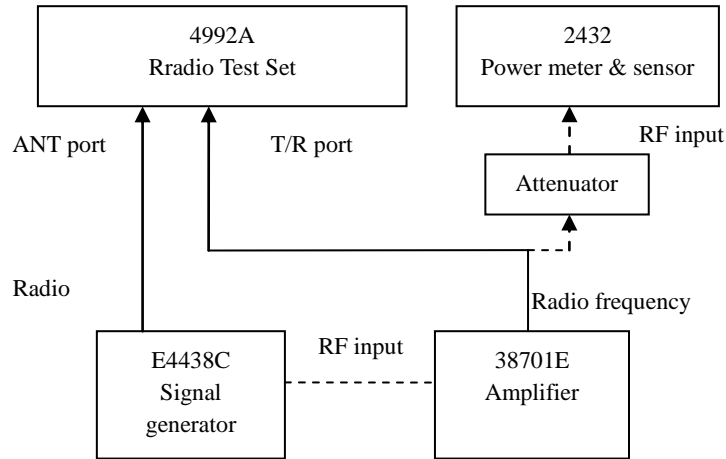
Fig. 7- 10 Connection Diagram of In-band Power Accuracy Test of Spectrum Analyzer

Instrument / equipment:

Signal generator(recommended model: Agilent E4438C)

Power amplifier(recommended model: S41-20)

Power meter(recommended model: 2432, 2434, etc.)

Power sensor(recommended model: 23211, 71712, N9304, etc.)

Attenuator group: two 50W/20dB attenuators

N/BNCadapter: one

RF cable: two (80cm)

c) Test steps

1) First test the indicators of the T/R port. As shown in Fig. 10, turn on the instrument and warm it up for 30min.

2) Perform zero adjustment and calibration of the power meter and power sensor.

3) Set the output of the signal source as follows.

Frequency: 999MHz;

Power: -25 dBm

RF: OFF

Connect the output of the signal source to the RF input end of the amplifier through the cable. Then connect the amplifier output to the sensor of the power meter through the attenuator group.

4) Open the output of the signal source, adjust its output power, and observe the measured power. The value measured with the power meter is as follows:

P measurement =43dBm to 40dB.

5) Open the spectrum analyzer window by pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Port: T/R

Center: 999MHz

Reference: -50dBm

sweep width: 1MHz

resolution bandwidth: 10kHz

Other parameters: auto.

6) Close the output of the signal source, and directly connect the output of the power amplifier to

the T/R port of the tested device.

7) Set the cursor of the spectrum analyzer to the maximum peak. If the power reading is 43dBm±3dB and the spectrum analyzer is not subject to IF overload, the upper limit of the power measurement range of the spectrum analyzer is more than or equal to +43dBm.

8) The lower limit of the power measurement range of the spectrum analyzer is the displayed average noise level. Connect the T/R port to the matching load and change the spectrum analyzer setting as follows.

Reference: -40dBm

sweep width: 10kHz

resolution bandwidth: 10Hz

Average: ON

Averaging times:16

When the trace becomes stable, test the peak value of the trace with the cursor and check whether the displayed average noise level of this port is no more than -50dBm. Record the above results in the test record table A.21.

9) Test the indicators of the ANT port. As shown in the figure, connect the output signal of the signal source to the ANT port of the tested device.

Set the output of the signal source as follows.

Frequency: 499MHz;

Power: -25 dBm

10) Open the spectrum analyzer window by pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Port: ANT

Center frequency: 499MHz

Reference: 0dBm

sweep width: 1MHz

resolution bandwidth: 10kHz

Other parameters: auto.

11) Set the cursor of the spectrum analyzer to the maximum peak. If the power reading is -10dBm±3dB and the spectrum analyzer is not subject to IF overload, the upper limit of the power measurement range of the spectrum analyzer is more than or equal to -10dBm.

12) The lower limit of the power measurement range of the spectrum analyzer is the displayed average noise level. Apply the matching load on the ANT port, and change the spectrum analyzer setting as follows.

Reference: -80dBm

sweep width: 10kHz

resolution bandwidth: 10Hz

Average: ON

Averaging times:16

When the trace becomes stable, test the peak value of the trace with the cursor and check whether the displayed average noise level of this port is no more than -110dBm. Record the above results in the test record table A.21.

E. Accuracy of amplitude measurement

a) Test items

The output of the high-accuracy signal source and the level test result of the power meter are applied as the benchmarks to check the level test accuracy of the spectrum analyzer. The accuracy requirement is ±3dB.

b) Test block diagram and meters

The test block diagram and meters are the same as those in the input power measurement range test.

c) Test steps

1) As shown in Fig. 7-10, turn on the test meters, and warm them up for 30min.

2) Perform zero adjustment and calibration of the power meter and power sensor.

3) First the output of the signal generator to the ANT port of the tested device. Set the output as follows.

Frequency: 3MHz;

Power: -10 dBm

RF: ON

4) Open the spectrum analyzer window by pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Port: ANT

Center frequency: 3MHz

Reference: 0dBm

sweep width: 10kHz

resolution bandwidth: 100Hz

Set the cursor at the peak value, read the level value of the cursor, and record the results in the test result table A.22.

5) Change the output frequency and power of the signal source according to Table A.22. Set the center frequency and reference level of the tested spectrum analyzer according to the input signal, and record the results in the test result table A.22.

6) In the test of the power measurement accuracy of the T/R port, the output of the signal generator is used as the benchmark for the test signal of 20dBm or below. The test method is the same as Step 3) to 5). Record the results in the test record table A.22.

7) In the test of the power measurement accuracy (+43dBm) of the T/R port, first calibrate the high-power signal generation system composed of the signal source and amplifier. Set the output of the signal source as follows.

Frequency: 3MHz;

Power: -25 dBm

RF: OFF

Connect the output of the signal source to the input end of the amplifier, the output of the signal source to the attenuator group (note that the signal should be connected to the high-power attenuator at first) and the output of the attenuator group to the sensor of the power meter. Set the amplifier as follows.

Rear internal amplitude stabilization: ON

Frequency: 3MHz;

Output power: 43dBm

Enable the RF ON status of the signal generator, and record the current reading of the power meter.

This reading +23dB is used as the actual signal power of the output at this frequency point. Record this reading in the column "Calibrated Value of Power Meter" of Table A.22.

Change the output frequency of the signal generator according to Table A.22. At the same time, change the frequency of the amplifier and power meter correspondingly. Test the calibrated values of the power meter corresponding to the high-power outputs of all points. Record such values in Table A.22.

8) Close the output of the signal generator, and connect the amplifier output to the T/R port of the tested device.

9) Set the output frequency of the signal generator and the frequency of the amplifier according to the frequency point calibrated in 7). Enable the RF ON status, and correspondingly adjust the center frequency and reference level of the spectrum analyzer. Set the cursor at the peak value, record the level value of the cursor, and record the results in the test record table A.22.

18. Accuracy of frequency measurement of audio meter

a) Test items

The audio signal generated by the standard audio generator/analyzer is applied as the benchmark to check the audio frequency measurement accuracy of the tested device. The audio frequency range of this instrument is 15Hz to 20kHz, and the frequency accuracy is ±2Hz.

b) Test block diagram and meters

Audio generator/analyzer	4992A Rradio Test Set
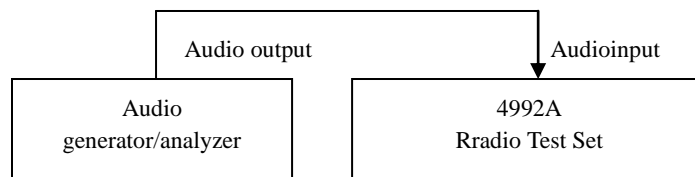
Fig. 7-11 Connection Diagram of Audio Frequency Test

Instrument / equipment:

Audio generator/analyzer (recommended model: VA-2230A and Agilent 8903A)

BNC cable: one (100cm)

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Set the signal generation part of the audio generator/analyzer. The audio output amplitude is set as 1Vrms.

3) Open the audio meter window by pressing the [Audio] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Impedance: high impedance

Range: 0.01V to 3V

4) Set the audio output parameters of the audio generator/analyzer according to Table A.23. Record the audio frequency reading of the tested device in Table A.23.

19. Voltage measurement accuracy of audio meter

a) Test items

The audio signal generated by the standard audio generator/analyzer is applied as the benchmark to test the audio voltage measurement accuracy of the tested device. The audio voltage measurement accuracy of this instrument is ±5%.

b) Test block diagram and meters

The test block diagram and meters are the same as those in the audio frequency test.

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Set the signal generation of the audio generator/analyzer as follows.

Frequency: 20Hz;

Amplitude: 20mVrms

Offset: 0V

Output impedance : 50Ω

Output: ON.

3) Open the audio meter window by pressing the [Audio] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows.

Average: OFF

Impedance: high impedance

Range: 0.01V to 3V

Record the results in the test record table A.24.

4) Set the audio output parameters of the audio generator/analyzer according to Table A.24. Record the audio voltage readings in Table A.24.

20.Distortion measurement accuracy of audio meter

a) Test items

The ZN5541 audio distortion source is applied to generate audio distortion signals, and VA-2230A test results are applied as the comparison benchmark, to check the audio distortion measurement accuracy of the tested device. The accuracy of audio distortion measurement of this instrument is as follows: $\pm (5\% \times$ measured value+0.1%) and 1-20%.

b) Test block diagram and meters
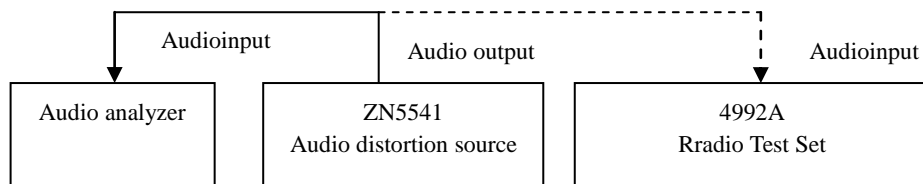
Fig. 7-12 Connection Diagram of Audio Distortion Test

Instrument / equipment:

Audio distortion source(recommended model: ZN5541)

Audio analyzer (recommended model: VA-2230A)

BNC cable: one (100cm)

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Set the standard ZN5541 audio distortion source as follows:

Fundamental wave frequency: 1kHz

Adder: 20Hz to 1kHz

In the case of fundamental wave output, adjust the voltage of the fundamental wave, until the output voltage amplitude is about 1V.

In the case of distortion wave output, adjust the harmonic voltage, until the output voltage amplitude is about 1V.

Select the distortion wave output as the final button mode.

First connect the output of the distortion source to the input end of Channel L of the audio analyzer.

3) Set the audio analyzer as follows:

Input channel: Channel L ON

Measurement mode: THD

INPUT: 100kΩ UNBAL

SP: SLOW

4) Set the distortion degree of ZN5541 audio distortion source according to the requirements of Table A.25, and record the distortion test results of the audio analyzer.

5) Connect the output of the distortion source to the audio input end of the tested device. Open the audio meter window by pressing the [Audio] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows:

Distortion type: THD

Average: OFF

Impedance: high impedance

Range: 0.01V to 3V

6) Set the distortion degree of ZN5541 audio distortion source according to the requirements of Table A.25, and record the distortion test results of the tested device in Table A.25.

21. SINAD measurement accuracy of audio meter

a) Test items

The ZN5541 audio distortion source is applied to generate audio distortion signals, and the test results of the standard audio analyzer are used as the comparison benchmark to test the accuracy of audio SINAD measurement of the tested device. The accuracy of audio SINAD measurement of this instrument is as follows: ±1.5dB (8-35dB).

b) Test block diagram and meters

The test block diagram and meters are the same as those in the audio distortion meter test.

c) Test steps

1) Connect the device as shown in the figure, start it, and warm it up for 30min.

2) Set the standard ZN5541 audio distortion source as follows:

Fundamental wave frequency: 1kHz

Adder: 20Hz to 1kHz

In the case of fundamental wave output, adjust the voltage of the fundamental wave, until the output voltage amplitude is about 1V.

In the case of distortion wave output, adjust the harmonic voltage, until the output voltage amplitude is about 1V.

Select the distortion wave output as the final button mode.

First connect the output of the distortion source to the input end of Channel L of the audio analyzer.

3) Set the audio analyzer as follows:

Input channel: Channel L ON

Measurement mode: SINAD

INPUT: 100kΩ UNBAL

SP: SLOW

4) Set the distortion degree of ZN5541 audio distortion source according to the requirements of Table A.25, and record the distortion test results of the audio analyzer.

5) Connect the output of the distortion source to the audio input end of the tested device. Open the audio meter window of the tested device by pressing the [Audio] hard key or pressing the [Measurement] hard key and setting the instrument menu. Set it as follows:

Average: OFF

Impedance: high impedance

Range: 0.01V to 3V

6) Set the distortion degree of the ZN5541 audio distortion source according to the requirements of Table A.26 and the test results of the audio analyzer, and record the SINAD test results of VA-2230A audio analyzer and the tested device in Table A.26.

22.Measurement accuracy of digital voltmeter

a) Test items

The output signal of the function generator is used as the benchmark to test the accuracy of Vrms, Vpeak and Vavg measurement results of the digital voltmeter in the AC and DC measurement mode.

The indicator requirement is ±10% (0.1V to 3V).

b) Test block diagram and meters

The test block diagram is the same as that of the audio frequency test.

Instrument / equipment:

Audio generator/analyzer (recommended model: Agilent 8903A)

One BNC cable (100cm)

c) Test steps of AC measurement mode

1) Complete the test connection as shown in the figure, start the instrument and warm it up for 30min.

2) Set the audio output parameters of the audio generator/analyzer as follows:

Waveform: sine

Waveform configuration: amplitude: 1Vp

Frequency: 1kHz;

DC bias: 0V

Output configuration: non-balanced output

Impedance : 50Ω

3) Open the digital voltmeter window of the tested device by pressing the [Measurement] hard key and setting the instrument menu, and set it as follows:

Mode: AC

Range: 0.1V to 3V

Unit: V

Resolution: 0.001

Average: OFF

4) Record the measurement results of three indicators of the digital voltmeter in Table A.27.

5) Change the output signal amplitude of the audio generator according to Table A.27, and record the measurement results of three indicators of the digital voltmeter in Table A.27.

d) Test steps of DC measurement mode

1) Change the output of the audio generator/analyzer as follows:

Waveform: DC

Waveform configuration:1V (amplitude)

The amplitude of the DC signal is about 1V.

Connect the signal to the audio/DVM input end of the tested instrument.

2) Change the settings of the digital voltmeter window as follows:

Mode: DC

3) Read the voltage test results. In this case, the effective value, positive peak value and average value should be the same. Record test results in Table A.27.

4) Change the amplitude of the DC output signal of the audio generator according to Table A.27, and record the measurement results of three indicators of the digital voltmeter in Table A.27.

23.Oscilloscope (tested if any)

A. Vertical measurement accuracy

a) Test items

The external audio/DVM signal and internal demodulation signal can be tested with the oscilloscope. In this test, the external input signal is applied as the investigation target and the output signal of the high-accuracy function generator is used as the benchmark to respectively test the vertical measurement accuracy of the oscilloscope according to the signal input channel requirements.

The vertical measurement accuracy of this instrument is 10% (×1 level).

b) Test block diagram and meters
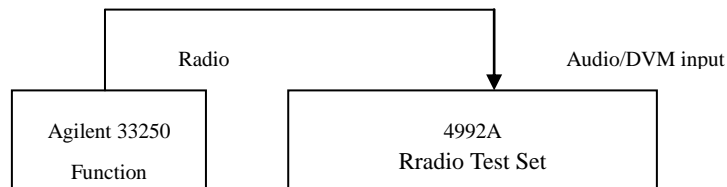
Fig. 7-13 Connection Diagram of Measurement Accuracy Test of Oscilloscope

Instrument / equipment:

Function generator (recommended model: Agilent 33250A and Agilent 8903A)

One BNC cable (100cm)

c) Test steps

1) As shown in the figure, connect the instrument, turn on it and warm it up for 30min.

2) First test the measurement   accuracy of the audio input signal. Then set the output parameters of the function generator as follows:

Waveform: sine

Amplitude: 0.2Vp-p

Frequency: 1kHz;

DC bias: 0V

Impedance: High Z

3) Open the oscilloscope window of the tested device by pressing the [Measurement] hard key and setting the instrument menu, and set it as follows:

Time/interval: 1ms

Amplitude/interval: 100mV

Reference position: 4

Trigger: trigger mode: normal

Pules edge: rising

Trigger level: 0V

Trigger position: 0nS

Port setting: external audio

External audio setting: impedance: high impedance

Range: 0.1V to 3V

Enable the oscilloscope cursor function, measure the amplitude of the input signal, and record the results in the test record table A.28.

4) Set the amplitude of the AC sine signal of the function generator according to the table, properly adjust the vertical-axis display setting of the oscilloscope, measure the amplitude of the input signal with the cursor function of the oscilloscope, and record the results in the test record table A.28.

5) Then test the measurement accuracy of the AC input signal of DVM, and change the oscilloscope input setting as follows:

Port setting: DVM

DVM setting: coupling mode: AC

Range: 0.1V to 3V

6) Repeat Step 4) and record the results in the test record table A.28.

7) Then test the measurement   accuracy of the DC input signal of DVM, and change the DC output signal of the function generator.

8) Based on Step 5), and change the oscilloscope input setting as follows:

DVM setting: coupling mode: DC

9) Set the amplitude of the DC output signal of the function generator according to the table, properly adjust the vertical-axis display setting of the oscilloscope, measure the amplitude of the input signal with the cursor function of the oscilloscope, and record the results in the test record table A.28.

B. Horizontal measurement   accuracy

a) Test items

The output pulse width of the function generator is applied as the benchmark to test the Δt measurement accuracy of the oscilloscope, i.e. the horizontal time measurement accuracy. The requirement of this indicator is ±3%.

b) Test block diagram and meters

The test block diagram and meters are the same as those in the vertical measurement accuracy test of the oscilloscope.

c) Test steps

1) Complete the test connection as shown in the figure, start the instrument and warm it up for 30min.

2) Set the pulse signal of the function generator as follows:

Waveform: pulse

Amplitude: 1V

Cycle: 400ms

Pulse width: 200ms

3) Open the oscilloscope window of the tested device by pressing the [Measurement] hard key and setting the instrument menu, and set it as follows:

Time/interval: 50ms

Amplitude/interval: 500mV

Reference position: 4

Trigger: trigger mode: normal

Pules edge: rising

Trigger level: 0V

Trigger position: 0nS

Port setting: DVM

DVM setting: coupling mode: DC

Range: 0.1V to 3V

4) Test the pulse width with the cursor function, and record the result in the performance test record table A.29.

24. Cable test

A. Measurement accuracy of standing wave ratio (VSWR)

a) Test items

The standing wave ratio of the tested instrument is measured in the open-circuit and matching status of the port after calibration.

The indicator requirements are as follows: 1.10-10.00dB (2MHz to 10MHz), 1.10-15.00dB (10MHz to 1000MHz).

b) Test block diagram and meters
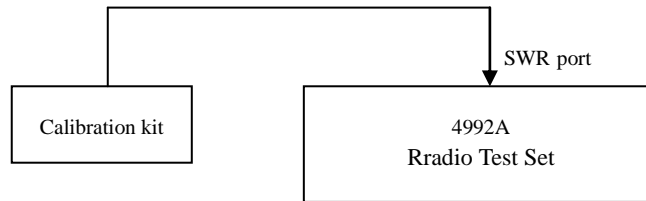
Fig. 7-14 Connection Diagram of SWR Measurement Range Test

Instrument / equipment:

N type calibration kit(recommended model: 31101A)

N type calibration kit(recommended model: Agilent 85055A)

c) Test steps

1) Turn on the instrument for 30min warm-up.

2) Open the cable test window of the tested device by pressing the [Cable] hard key or pressing the [Measurement] hard key and setting the instrument menu. Click this window, and the cable test menu will pop up in the right side. Set it as follows:

Frequency setting: center frequency: 501MHz

sweep width: 998MHz

Test type: SWR

3) Press the [Calibration] soft key, click "Start calibration", and connect the open circuit, short circuit and matching calibration kit in sequence to the SWR port according to the prompts, and complete calibration. Click "Calibration Done", and save the calibration data.

4) After calibration, connect the SWR port with the 25Ω air line, and apply the matching load at the end.

5) Set the vertical-axis bottom value of the display as 1 and the top value as 11.

6) With reference to Table A.30, measure the standing wave ratio of each point with the cursor function, and record the results in the test result table A.30.

B. Measurement accuracy of distance-to-fault (DTF) measurement

a) Test items

The DTF measurement   accuracy reflects the DTF accuracy of the whole instrument. In this test, the cable of the known material and length is measured to locate breaking points.

The indicator requirement is ±10%

b) Test block diagram and meters
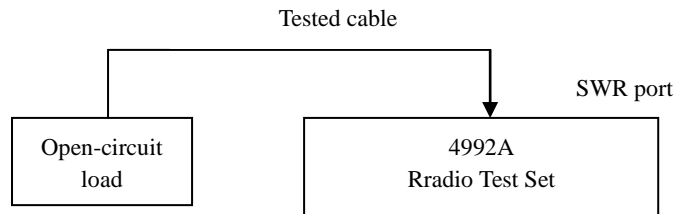
Fig. 7-15 Connection Diagram of DTF Test

Instrument / equipment:

N type calibration kit(recommended model: 31101)

Standard test cable: 4m

c) Test steps

1) Turn on the instrument for 30min warm-up.

2) Open the cable test window of the tested device by pressing the [Cable] hard key or pressing the [Measurement] hard key and setting the instrument menu. Click this window, and the cable test menu will pop up in the right side. Set it as follows:

Frequency setting: center frequency: 501MHz

sweep width: 998MHz

Test type: DTF

DTF test: rate: 0.77

Display setting: 0 as the vertical-axis top value and 50 as the bottom value.

3) Press the [Calibration] soft key, click "Start calibration", and connect the open circuit, short circuit and matching calibration kit in sequence to the SWR port according to the prompts, and complete calibration. Click "Calibration Done", and save the calibration data.

4) After calibration, connect the SWR port with the 4m long test cable, and apply the open-circuit load on the cable end.

5) Measure the distance of fault points (maximum reflection peak) with the cursor function, and record the results in the test result record table A.30.

Appendix A

Schedule: Test Results of Performance Characteristics of 4992A Radio Test Set

Instrument No.: Test Personnel:
Test Condition: Test Date: YY/MM/DD

Table A.1　Function Test of 4992A Radio Test Set

Test Item No.	Test Item Name	Conclusion
1	Check before work	
2	Start-up check	
3	Functional test	

Table A.2 Frequency Test Record Table of RF Source

RF source	Frequency (MHz)	Acceptable range	Measured value (MHz)	Conclusion
RF source 1	2.000,000	2.000,000MHz±4Hz		
	1,000.000,000	1,000.000,000MHz±2kHz		
RF source 2	2.000,000	2.000,000MHz±4Hz		
	400.000,000	400.000,000MHz±800Hz		

A.3 Record Table of Output Power Range and Accuracy Test of RF Source

RF source	Frequency (MHz)	Power (dBm)	Measured value (dBm)	Acceptable range	Conclusion
RF source 1	99 (SWR)	-5		-5dBm±2dB	
		-35		-35dBm±2dB	
		-55		-55dBm±2dB	
	899 (SWR)	-5		-5dBm±2dB	
		-35		-35dBm±2dB	
		-55		-55dBm±2dB	
	99 (T/R)	-50		-50dBm±2dB	
		-80		-80dBm±2dB	
		-100		-100dBm±2dB	
	899 (T/R)	-50		-50dBm±2dB	
		-80		-80dBm±2dB	
		-100		-100dBm±2dB	
	99 (ANT)	-5		-5dBm±2dB	
		-30		-30dBm±2dB	
		-50		-50dBm±2dB	
		-70		-70dBm±2dB	
		-100		-100dBm±2dB	
	899 (ANT)	-5		-5dBm±2dB	
		-30		-30dBm±2dB	
		-50		-50dBm±2dB	
		-70		-70dBm±2dB	
		-100		-100dBm±2dB	

A.3(continued) Record Table of Output Power Range and Accuracy Test of RF Source

RF source	Frequency (MHz)	Power(dBm)	Acceptable range	Measured value(dBm)	Conclusion
RF source 2	99 (ANT)	0	0dBm±2dB		
		-5	-5dBm±2dB		
		-30	-30dBm±2dB		
		-50	-50dBm±2dB		
		-70	-70dBm±2dB		
		-100	-100dBm±2dB		
	399 (ANT)	0	0dBm±2dB		
		-5	-5dBm±2dB		
		-30	-30dBm±2dB		
		-50	-50dBm±2dB		
		-70	-70dBm±2dB		
		-100	-100dBm±2dB		

Table A.4 Test Record Table of Output Phase Noise of RF Source

RF source	Frequency (MHz)	Frequency deviation (kHz)	Acceptable range (dBc/Hz)	Measured value (dBc/Hz)	Conclusion
RF source 1	1,000	20	≤-95		
RF source 2	400	20	≤-95		

Table A.5 Test Records of Parasitic Harmonics of RF Source

RF source	Carrier frequency (MHz)	Port	Acceptable range (dBc)	Measured value Frequency (MHz)	Measured value Amplitude (dBc)	Conclusion
RF source 1	2~1000	SWR	≤-30			
		ANT	≤-30			
RF source 2	2~400	ANT	≤-30			

Table A.6 Test Records of Non-parasitic Harmonics of RF Source

RF source	Carrier frequency (MHz)	Port	Acceptable range (dBc)	Measured value (dBc)	Conclusion
RF source 1	2~1000	SWR	≤-35		
		ANT	≤-35		
RF source 2	2~400	ANT	≤-35		

Table A.7 Test Records of Internal Amplitude Modulation Accuracy of RF Source 1

RF source	Modulation rate (Hz)	Modulation degree	Acceptable range	Measured value	Conclusion
RF source 1 500MHz	150	10%	10%±2.5%		
		50%	50%±4.5%		
		90%	90%±6.5%		
	1,000	10%	10%±2.5%		
		50%	50%±4.5%		
		90%	90%±6.5%		

		10%	10%±2.5%		
	5,000	50%	50%±4.5%		
		90%	90%±6.5%		

Table A.8 Test Records of Internal Frequency Modulation Accuracy of RF Source 1

RF source	Modulation frequency (Hz)	Frequency deviation (kHz)	Acceptable range (kHz)	Measured value (kHz)	Conclusion
RF source 1	150	100	100±5		
	1,000	100	100±5		
	5,000	100	100±5		

Table A.9 Test Records of Frequency Range and Accuracy of Audio Source

Audio source	Frequency (Hz)	Acceptable range (Hz)	Measured value (Hz)	Conclusion
Audio source 1	20	20±2		
	20,000	20,000±2		
Audio source 2	20	20±2		
	20,000	20,000±2		

Table A.10   Test Records of Level Range and Accuracy of Audio Source

Frequency (Hz)	Level (mVrms)	Acceptable range (mVrms)	Measured value (mVrms)	Conclusion
1,000	20	20±4		
	100	100±12		
	1,570	1,570±159		

Table A.11 Test Records of Harmonic Distortion of Audio Source

Frequency	Acceptable range	Measured value	Conclusion
1kHz	<3%		

Table A.12   Dual-tone Signal Test Records

Dual-tone frequency	Measured value, 1kHz (Yes/No)	Measured value, 1.6kHz (Yes/No)	Conclusion
1kHz + 1.6kHz			

Table A.13   Test Records of RF Power Measurement Accuracy

Synthetic source+amplifier system setting		Measured value (dBm)	Acceptable range	Conclusion
2MHz	20dBm		20dBm±1dB	
50MHz	20dBm		20dBm±1dB	
800MHz	20dBm		20dBm±1dB	
	43dBm		43dBm±1dB	
1,000MHz	20dBm		20dBm±1dB	
	43dBm		43dBm±1dB	

Table A.14   Test Records of RF Frequency Error Measurement Accuracy

Synthetic source setting		Measured value of 4992A (Hz)	Acceptable range (Hz)	Conclusion
500MHz	-10dBm		±2	

	-30dBm			
	-60dBm			
500MHz +200kHz	-10dBm		±2	
	-30dBm			
500MHz -200kHz	-10dBm		±2	
	-30dBm			

Table A.15　Test Records of Measurement Accuracy of Received Signal Strength

Port	Frequency of synthetic source (MHz)	Power of synthetic source (dBm)	Measured value of 4992A (dBm)	Difference (dB)	Acceptable range (dB)	Conclusion
ANT	2	-10			±3	
		-70				
		-110				
	499	-10			±3	
		-70				
		-110				
	999	-10			±3	
		-70				
		-110				
T/R	2	+20			±3	
		0				
		-50				
	499	+20			±3	
		0				
		-50				
	999	+20			±3	
		0				
		-50				

Table A.16 Records of Am Demodulation Measurement Accuracy

Modulation depth of synthetic source	Acceptable range	Measured value of 4992A	Conclusion
30%	30%±5%		
50%	50%±5%		
90%	90%±5%		

Table A.17　Records of FMDemodulation　Measurement Accuracy

Modulation rate of synthetic source	Frequency modulation deviation of synthetic source(kHz)	Acceptable range (kHz)	Measured value of 4992A(kHz)	Conclusion
150Hz	0.5	0.5±5%		
	100	100±5%		
1kHz	0.5	0.5±5%		
	100	100±5%		

Table A.18 Test Records of Frequency Range of Spectrum Analyzer

Input signal frequency (MHz)	Measured value of 4992A (MHz)	Acceptable range	Conclusion
2		2MHz±507.5Hz	
1000		1000MHz±507.5Hz	

Table A.19 Test Records of Average Noise Level Display of Spectrum Analyzer

Center frequency (MHz)	Reference level (dBm)	Measured value of 4992A (dBm)	Acceptable range (dBm)	Conclusion
3	＞-70		≤-110	
	≤-70		≤-130	
499	＞-70		≤-110	
	≤-70		≤-130	
999	＞-70		≤-110	
	≤-70		≤-130	

Table A.20 Test Records of Residual Response of Spectrum Analyzer

Reference level (dBm)	Frequency point (MHz)	Amplitude	Acceptable range	Conclusion
＞-70			≤-70dBm	
≤-70			≤-80dBm	

Table A.21 Test Records of Input Power Measurement Range of Spectrum Analyzer

Port	Acceptable power range	Measured value of 4992A (dBm)	Conclusion
T/R (999MHz)	High end: +43dBm±3dB		
	Low end: ≤-50dBm		
ANT (499MHz)	High end: -10dBm±3dB		
	Low end: ≤-110dBm		

Table A.22　Test Records of Amplitude Measurement Accuracy of Spectrum Analyzer

Port	Frequency	Input power (dBm)	Measured value of 4992A (dBm)	Acceptable range (dBm)	Conclusion
ANT	3MHz	-10		-10±3	
		-30		-30±3	
		-50		-50±3	
		-70		-70±3	
		-90		-90±3	
		-110		-110±3	
	499MHz	-10		-10±3	
		-30		-30±3	
		-50		-50±3	
		-70		-70±3	
		-90		-90±3	
		-110		-110±3	
	999MHz	-10		-10±3	
		-30		-30±3	
		-50		-50±3	

		-70		-70±3	
		-90		-90±3	
		-110		-110±3	

Table A.22 (continued) Test Records of Amplitude Measurement Accuracy of Spectrum Analyzer

Port	Frequency	Input power (dBm)	Measured value of 4992A (dBm)	Acceptable range (dBm)	Conclusion
T/R	3MHz	20		20±3	
		0		0±3	
		-20		-20±3	
		-50		-50±3	
	499MHz	20		20±3	
		0		0±3	
		-20		-20±3	
		-50		-50±3	
	999MHz	20		20±3	
		0		0±3	
		-20		-20±3	
		-50		-50±3	

Table A.23 Test Records of Frequency Measurement Accuracy of Audio Meter

Frequency of tested audio signal(Hz)	Measured value of 4992A (Hz)	Acceptable range (Hz)	Conclusion
20		20±2	
1,000		1,000±2	
20,000		20,000±2	

Table A.24 Test Records of Voltage Measurement Accuracy of Audio Meter

Range	Audio frequency (Hz)	Audio amplitude (mVrms)	Acceptable range (mVrms)	Measured value of 4992A (mVrms)	Conclusion
0.01V~3V	20	20	20±6		
		1,000	1,000±55		
		2,000	2,000±105		
	1,000	20	20±6		
		1,000	1,000±55		
		2,000	2,000±105		
	20kHz	20	20±6		
		1,000	1,000±55		
		2,000	2,000±105		

Table A.25 Test Records of Distortion Measurement Accuracy of Audio Meter

ZN5541 setting	Measured value of VA-2230A	Measured value of 4992A	Measurement error	Acceptable range	Conclusion
1%				±0.15%	
10%				±0.6%	
20%				±1.1%	

Table A.26 Test Records of SINAD Measurement Accuracy of Audio Meter

ZN5541 setting	Measured value of VA-2230A (dB)	Measured value of 4992A (dB)	Difference (dB)	Acceptable range (dB)	Conclusion
40%（about 8dB）					
10%（about 20dB）				±1.5	
1%（about 40dB）					

Table A.27 Test Records of Measurement Accuracy of Digital Voltmeter

Measurement mode	Setting of output signal	Measured value of 4992A	Error	Acceptable range	Conclusion
AC (1kHz)	100mVp			±10%	
	1Vp			±10%	
	3Vp			±10%	
DC	100mV			±10%	
	1V			±10%	
	3V			±10%	

Table A.28 Test Records of Vertical Measurement Accuracy of Oscilloscope

Input selection	Channel selection		Input signal amplitude	Measured value of 4992A	Acceptable range	Conclusion
Audioinput (1kHz)	0.1V~3V		0.2 V_{p-p}		0.2±0.02 V_{p-p}	
			2 V_{p-p}		2±0.2 V_{p-p}	
			5 V_{p-p}		5±0.5 V_{p-p}	
DVM input	AC (1kHz)	0.1V~3V	0.2 V_{p-p}		0.2±0.02 V_{p-p}	
			2 V_{p-p}		2±0.2 V_{p-p}	
			5 V_{p-p}		5±0.5 V_{p-p}	
	DC	0.1V~3V	0.1V		0.1±0.01V	
			1V		1±0.1V	
			3V		3±0.3V	

Table A.29　Test Records of Horizontal Measurement Accuracy of Oscilloscope

Width of tested pulse signal ms()	Measured value of 4992A (ms)	Error	Acceptable range	Conclusion
200			±3%	

Table A.30　Cable Test Records

Measurement Item	Measured value of 4992A	Acceptable range	Conclusion
SWR measurement accuracy (130MHz)		1.22~1.49	
SWR measurement accuracy (300MHz)		1.77~2.15	
SWR measurement accuracy (500MHz)		2.50~3.04	
SWR measurement accuracy (700MHz)		2.80~4.20	
SWR measurement accuracy (1000MHz)		3.18~4.75	
DTF measurement accuracy		4m±10%	

Article III Maintenance Instructions

Chapter VIII Failure Information Description And Repair Method

This chapter can help you to find problems and receive after-sales services, including the explanation of internal error information of the Radio Test Set.

If any problem occurs in operation of 4992A Radio Test Set or you want to purchase relevant components, options or accessories, we will provide the complete after-sales services.

Generally, problems are caused by the hardware, software or improper use. Once any problem occurs, contact us promptly. If the Radio Test Set is still within the warranty, we will provide the maintenance services free of charge according to the commitment in the warranty sheet. If the warranty is expired, we will only charge the costs.

Section 1 Fault Information Description

	Statement	**This part aims to guide you to simply judge and eliminate faults of 4992A Radio Test Set. If necessary, please report the problem to the manufacturer as accurate as possible so that we can solve this problem as soon as possible.**

If any problem occurs to 4992A, you can check the instrument according to the following prompts. If the problem exists, contact us.

✧ If 4992A cannot be started when the Power key is pressed, check whether the power supply is normal, whether the adapter indicator is ON and whether the power supply battery is normal. If the above items are normal, the instrument failure may occur. In this case, contact us for repair.

✧ If the system or application program of 4992A cannot be enabled after start-up, press [Reset] to make 4992A return into the known status. If this instrument cannot work normally, instrument failure may occur. In this case, contact us for repair.

✧ If the touch screen of 4992Ahas no response, calibrate the touch screen in the [System] menu. If the touch screen still fails in response, instrument failure may occur. In this case, contact us for repair.

✧ If the performance indicators of 4992A are abnormal, check whether the test tools and test environment conform to the requirements, whether the connector of the test port is damaged and whether the performance indicators of the calibration kit are normal. If the above items

are normal, instrument failure may occur. In this case, contact us for repair.

✧ If LAN communication of 4992A fails, check the IP address setting of PC and the yellow LED beside the LAN interface of the top panel. If this light does not flicker, check the LAN cable and connection.

Section 2 Rework Method

If any problem of 4992A cannot be solved easily, contact us by phone or fax. If the instrument has to be returned for repair, pack it according to the following steps.

1) Prepare one copy of paper file describing the instrument failure, and place it into the packing box together with the tester.

2) Pack the instrument with the original package to reduce possible damage.

3) Set pads in the four corners of the outer packing box, and place the instrument into the outer packing box.

4) Seal the opening of the packing box with a tape and strengthen the packing box with nylon straps;

5) Mark "Fragile!", "No collision!", "Handle with care!", etc. on the box.

6) Ship this instrument as a precision instrument, and keep a copy of all the shipping documents.