ADVANTEST
ADVANTEST CORPORATION

R3272

Spectrum Analyzer

Operation Manual

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Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this instrument, please read the manual carefully before using. Note that Advantest bears absolutely no responsibility for the result of operations caused due to incorrect or inappropriate use of this instrument.

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

- **Warning Labels**

Warning labels are applied to Advantest products in locations where specific dangers exist. Pay careful attention to these labels during handling. Do not remove or tear these labels. If you have any questions regarding warning labels, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

Symbols of those warning labels are shown below together with their meaning.

DANGER: Indicates an imminently hazardous situation which will result in death or serious personal injury.

WARNING: Indicates a potentially hazardous situation which will result in death or serious personal injury.

CAUTION: Indicates a potentially hazardous situation which will result in personal injury or a damage to property including the product.

- **Basic Precautions**

Please observe the following precautions to prevent fire, burn, electric shock, and personal injury.

- Use a power cable rated for the voltage in question. Be sure however to use a power cable conforming to safety standards of your nation when using a product overseas.
- When inserting the plug into the electrical outlet, first turn the power switch OFF and then insert the plug as far as it will go.
- When removing the plug from the electrical outlet, first turn the power switch OFF and then pull it out by gripping the plug. Do not pull on the power cable itself. Make sure your hands are dry at this time.
- Before turning on the power, be sure to check that the supply voltage matches the voltage requirements of the instrument.
- Connect the power cable to a power outlet that is connected to a protected ground terminal. Grounding will be defeated if you use an extension cord which does not include a protected ground terminal.
- Be sure to use fuses rated for the voltage in question.
- Do not use this instrument with the case open.
- Do not place anything on the product and do not apply excessive pressure to the product. Also, do not place flower pots or other containers containing liquid such as chemicals near this

product.

- When the product has ventilation outlets, do not stick or drop metal or easily flammable objects into the ventilation outlets.
- When using the product on a cart, fix it with belts to avoid its drop.
- When connecting the product to peripheral equipment, turn the power off.

- **Caution Symbols Used Within this Manual**

Symbols indicating items requiring caution which are used in this manual are shown below together with their meaning.

DANGER: Indicates an item where there is a danger of serious personal injury (death or serious injury).

WARNING: Indicates an item relating to personal safety or health.

CAUTION: Indicates an item relating to possible damage to the product or instrument or relating to a restriction on operation.

- **Safety Marks on the Product**

The following safety marks can be found on Advantest products.

 : ATTENTION - Refer to manual.

 : Protective ground (earth) terminal.

 : DANGER - High voltage.

 : CAUTION - Risk of electric shock.

- **Replacing Parts with Limited Life**

The following parts used in the instrument are main parts with limited life.
Replace the parts listed below before their expected lifespan has expired to maintain the performance and function of the instrument.
Note that the estimated lifespan for the parts listed below may be shortened by factors such as the environment where the instrument is stored or used, and how often the instrument is used.
The parts inside are not user-replaceable. For a part replacement, please contact the Advantest sales office for servicing.

Each product may use parts with limited life.
For more information, refer to the section in this document where the parts with limited life are described.

Main Parts with Limited Life

Part name	Life
Unit power supply	5 years
Fan motor	5 years
Electrolytic capacitor	5 years
LCD display	6 years
LCD backlight	2.5 years
Floppy disk drive	5 years
Memory backup battery	5 years

- **Hard Disk Mounted Products**

The operational warnings are listed below.

- Do not move, shock and vibrate the product while the power is turned on.
  Reading or writing data in the hard disk unit is performed with the memory disk turning at a high speed. It is a very delicate process.

- Store and operate the products under the following environmental conditions.
  An area with no sudden temperature changes.
  An area away from shock or vibrations.
  An area free from moisture, dirt, or dust.
  An area away from magnets or an instrument which generates a magnetic field.

- Make back-ups of important data.
  The data stored in the disk may become damaged if the product is mishandled. The hard disc has a limited life span which depends on the operational conditions. Note that there is no guarantee for any loss of data.

- **Precautions when Disposing of this Instrument**

When disposing of harmful substances, be sure dispose of them properly with abiding by the state-provided law.

Harmful substances: (1) PCB (polycarbon biphenyl)
(2) Mercury
(3) Ni-Cd (nickel cadmium)
(4) Other
Items possessing cyan, organic phosphorous and hexadic chromium and items which may leak cadmium or arsenic (excluding lead in solder).

Example: fluorescent tubes, batteries

Environmental Conditions

This instrument should be only be used in an area which satisfies the following conditions:

- An area free from corrosive gas
- An area away from direct sunlight
- A dust-free area
- An area free from vibrations
- Altitude of up to 2000 m

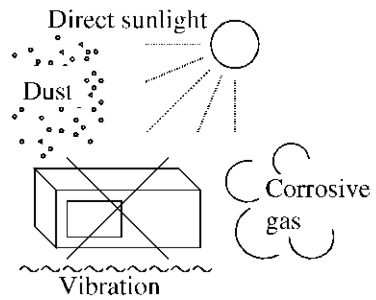
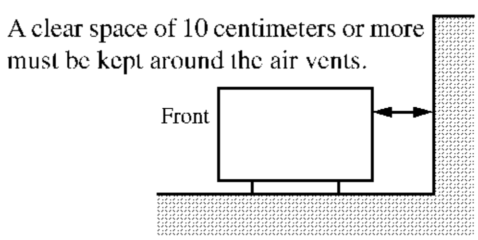


Figure-1 Environmental Conditions

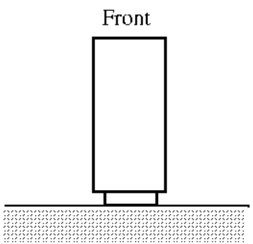
- Operating position



The instrument must be used in a horizontal position.
A cooling fan, which prevents the internal temperature from rising, is equipped with the instrument.
The air vents on the case must be unblocked.

Figure-2 Operating Position

- Storage position



This instrument should be stored in a horizontal position.
When placed in a vertical (upright) position for storage or transportation, ensure the instrument is stable and secure.

-Ensure the instrument is stable.
-Pay special attention not to fall.

Figure-3 Storage Position

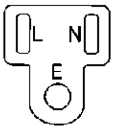
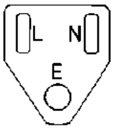
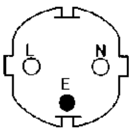
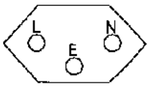
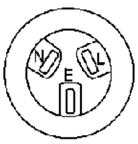
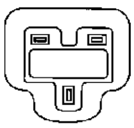
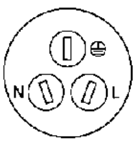
- The classification of the transient over-voltage, which exists typically in the main power supply, and the pollution degree is defined by IEC61010-1 and described below.

  Impulse withstand voltage (over-voltage) category II defined by IEC60364-4-443

  Pollution Degree 2

Types of Power Cable

Replace any references to the power cable type, according to the following table, with the appropriate power cable type for your country.

Plug configuration	Standards	Rating, color and length	Model number (Option number)
	PSE: Japan Electrical Appliance and Material Safety Law	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
	UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
	CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
	SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
	SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
	BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417
	CCC:China	250 V at 10 A Black 2 m (6 ft)	Straight: A114009 (Option 94) Angled: A114109

Certificate of Conformity

This is to certify, that

Spectrum Analyzer

R3272 Series

instrument, type, designation

complies with the provisions of the EMC Directive 89/336/EEC in accordance with EN50081-1 and EN50082-1 and Low Voltage Directive 73/23/EEC in accordance with EN61010.

ADVANTEST Corp.

Tokyo, Japan

ROHDE&SCHWARZ

Engineering and Sales GmbH

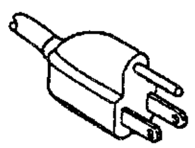
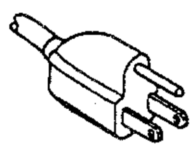
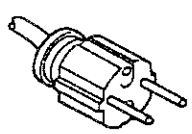
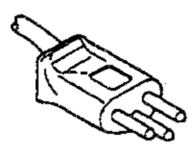
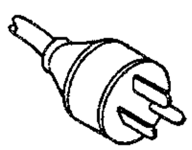
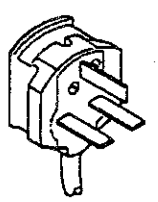
Munich, Germany

3272.00

Table of Power Cable Options

There are six power cable options (refer to following table).

Order power cable options by Model number.

	Plug configuration	Standards	Rating, color and length	Model number (Option number)
1		JIS: Japan Law on Electrical Appliances	125 V at 7 A Black 2 m (6 ft)	Straight: A01402 Angled: A01412
2		UL: United States of America CSA: Canada	125 V at 7 A Black 2 m (6 ft)	Straight: A01403 (Option 95) Angled: A01413
3		CEE: Europe DEMKO: Denmark NEMKO: Norway VDE: Germany KEMA: The Netherlands CEBEC: Belgium OVE: Austria FIMKO: Finland SEMKO: Sweden	250 V at 6 A Gray 2 m (6 ft)	Straight: A01404 (Option 96) Angled: A01414
4		SEV: Switzerland	250 V at 6 A Gray 2 m (6 ft)	Straight: A01405 (Option 97) Angled: A01415
5		SAA: Australia, New Zealand	250 V at 6 A Gray 2 m (6 ft)	Straight: A01406 (Option 98) Angled: ---------
6		BS: United Kingdom	250 V at 6 A Black 2 m (6 ft)	Straight: A01407 (Option 99) Angled: A01417

Part 1

PREFACE

■ In the Beginning

This manual explains all processes from the acceptance to actually operation of Spectrum analyzer R3272.
ADVANTEST reserves the right to change the content of this manual and other product information without notice.
 The address and the telephone number of ADVANTEST Corporation are described in the end of this manual. Refer for the inquiry etc.

■ How to read this manual

- **Notation in this manual**

  Reference : Information helpful to you. Point to a page number where it is explained.

  Note : Uses to explain for the supplementation.

- **Distinction of panel key and software key in this manual**

  Panel key : Shows the key of the solid line frame.

  (Example) SHIFT [●] , [7]

  Software key: Shows the key of the dotted line frame.

  (Example) [Delta MKR] , [FREQ OFS ON OFF]

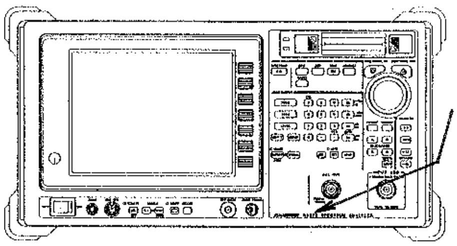
- **Notation for last page**

Some pages in this manual have a "*" mark on the upper right of page number. "*" means that it is the last page.

Confirmation of Product and Attachment

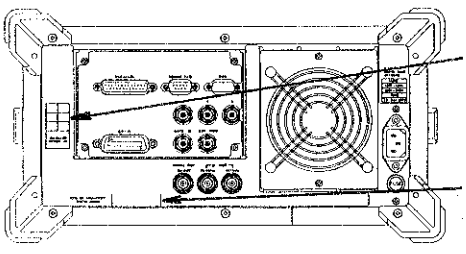
When you open packing, confirm the following in the beginning.
If any flaw, damage, and shortage in the product or the attachment, etc., is found, contact the nearest dealer or the sales and support office.

● Main unit



Confirmation position of type and name of product.

Confirm the product the same as the order from the name plate in the front panel.



Notation for built-in optional devices

Serial number.

Check the serial number marked on the rear panel, which shall be informed to us when you ask for repair.

● **Standard accessory lists.**
Note ***Order the addition of the accessory etc. with type name.***

Name of articles	Type name	Quantity	Remarks
Power cable	*1	1	
Input cable	A01036-0150	1	50Ω BNC cable 150 mm
N-BNC conversion adapter	JUG-201A/U	1	
Fuse	T6.3A/250V	1	
R3272 Operation Manual	ER3272	1	English

*1: ADVANTEST provides the power cables for each country.

■ Re-Calibration

This instrument needs re-calibration of frequency standard source and CAL OUT signal.
To satisfy the accuracy of the measurement, execute the re-calibration once in a year at least.
See the page of "Guarantee" at the end of the manual for the inquiry about the re-calibration.

■ LCD display

When this instrument is used in long hours at high temperature, a blurred section may arise on the LCD display. This problem comes from not a failure of the LCD display.
If this problem arises, turn off the power and turn on that.
The problem is solved.

TABLE OF CONTENTS

Chapter 1 INTRODUCTION

1. Outline of Product 1-2
2. Operating Conditions 1-3
   Operating environmental conditions 1-3
   Installation posture 1-4
3. Power Source 1-5
   Checking Power Requirements 1-5
   Changing the supply voltage 1-5
   Replacing the power fuse 1-6
   Connecting the Power Cable 1-8
4. Cleaning, Storage and Transportation 1-10
   Cleaning 1-10
   Storage 1-10
   Transportation 1-10
5. Notes on Use 1-11
   Case that abnormality occurs 1-11
   Warm up 1-11

Chapter 2 DESCRIPTION OF FRONT AND REAR PANELS

1. Description of the Front Panel 2-2
   MEASUREMENT Section 2-4
   ENTRY Section 2-4
   DISPLAY CONTROL Section 2-5
   MARKER Section 2-6
2. Description of the Rear Panel 2-7

Chapter 3 FUNDAMENTAL OPERATION

1. Initial power-on 3-2
   Connecting to AC power source 3-2
   Power-on 3-3
2. Operation keys 3-5
   Panel keys and soft keys 3-5
3. Annotation on the screen 3-9
4. Calibration 3-10
5. Measuring the power level 3-11
6. Measurement of Frequency 3-15
   Measurement with normal marker 3-15
   Measurement by frequency counter 3-17

Convenient functions MKR⇨CF,
MKR⇨REF 3-20
7. Dynamic Range and Sweep Rate 3-22

Chapter 4 BASIC OPERATION

1. When the Power is Turned ON 4-2
Reference frequency 4-2
Setting 4-2
2. When a High Level Signal Exists outside the Bandwidth 4-3
3. Local Feedthrough 4-5
4. Initialization 4-6

Chapter 5 SAMPLE MEASUREMENT

1. Measurement of Frequency 5-2
Sample measurement of approximately 200 MHz signal source 5-2
2. Measuring the modulation frequency and modulation index of AM signal 5-5
Sample measurement of AM wave of low modulation degree and high modulation index 5-6
Sample measurement of AM wave of high modulation frequency and low modulation index 5-10
3. Measurement of FM Wave 5-13
Sample measurement of FM wave of low modulation frequency 5-14
Sample measurement of FM wave of high modulation frequency and low m value ... 5-17
Sample measurement of the deviation of FM wave peak (Δf peak) 5-19
How to obtain m when FM modulation index m is small 5-22
4. Measurement of Pulse Modulated Wave ... 5-24
Pulse width (τ) 5-25
Carrier frequency (fc) 5-25
Peak power (Ppeak) 5-25
Mean power Pave (dBm) 5-25

5. Spectrum Analysis of Burst Signal 5-26
Measuring method 5-26

Chapter 6 RECORD AND OUTPUT

1. Record to the Memory Card 6-2
Usable Memory Card 6-2
Memory Card Specifications 6-3
Contents of Storage to Memory Card 6-3
Note on Handling the Memory Card 6-4
Insertion and Ejection of Memory Card ... 6-5
How to Initialize the Memory Card 6-6
How to Store into the Memory Card (Save Function) 6-7
How to Call from the Memory Card (Recall Function) 6-9
Back Up of the Memory Card 6-10
2. How to Output by the Printer 6-12
Connectable Printer 6-12
Specification of the Output Form 6-13
Output to the Printer 6-16
3. Output for Plotter 6-17
Available plotter 6-17
Setup for the plotter 6-17
Setup for the plotter format 6-18
Output to the plotter 6-19
Cancel for the plot output 6-19
4. Output to the File 6-21
Specifying the data output 6-21
Output to the file 6-22
Cancel for the output 6-23
File size 6-23
5. Setup for the Target Device of the Screen Data Output 6-24
Setup of the target device 6-24

Chapter 7 FUNCTION DESCRIPTIONS

1. Functions of Fundamental Keys 7-2
Center Frequency 7-2
Frequency Span 7-5
Reference Level 7-7

Resolution Bandwidth (RBW) 7-10
Video Bandwidth (VBW) 7-11
Selecting AUTO of Coupled Functions ... 7-12
Input Attenuator (ATT) 7-13
Input Key 7-14
Correction Factor Function 7-18
2. Functions of FORMAT Mode 7-20
Functions of TRACE mode 7-21
Explanation of Detector Mode Menu 7-28
Explanation of Limit Line Menu 7-29
Label Function 7-31
3. Functions of MARKER Section 7-32
Marker ON 7-32
Signal Track Mode 7-33
Peak Search 7-33
Multi-marker mode 7-38
Marker → (Marker to) 7-40
Other marker functions 7-42
Marker OFF 7-44
4. Functions of SWEEP Mode 7-45
Sweep Key 7-45
Explanation of Gated Sweep Function ... 7-46
Explanation of START Lump 7-49
Sweep Time 7-50
Sweep Mode Switching 7-51
5. Functions of MEASUREMENT Section 7-52
Explanation of OBW
(Occupied Bandwidth) Key 7-52
Explanation of ACP (Adjacent Channels
Leakage Power) Key 7-55
HARMONICS (higher harmonics)
measuring function 7-58
Function of CW key 7-59
6. Save Function 7-65
Save function menu 7-65
7. Recall Function 7-73
Recall function menu 7-73
8. Calibration Function 7-76
Recall function menu 7-76
9. System Functions 7-79
10. Window Function 7-81

Chapter 8 GPIB REMOTE PROGRAMMING

1. Introduction 8-2
   GPIB 8-2
   GPIB Setup 8-3
2. GPIB BUS Functions 8-5
   GPIB Interface Functions 8-5
   Controller Functions 8-6
   Responses to Interface Messages 8-7
   Message Exchange Protocol 8-9
3. Command Syntax 8-10
   Command Syntax 8-10
   Data Formats 8-11
4. Status Bytes 8-13
   Status Register 8-13
   Event Enable Register 8-17
   Standard Operation Status Register 8-18
   Status Byte Register 8-19
   Standard Event Register 8-21
5. List of GPIB Command Codes 8-22
6. Sample programs 8-38
   Data output format (talker) 8-42
   I/O of trace data 8-48
7. RS-232 Remote Control Function 5-59
   Compatibility of GPIB remote control and RS-232C remote control 8-59
   Setup for the measurement conditions ... 8-59
   Activation of the remote control 8-60
   Parameter setup window 8-61
   Interface connection 8-62
   Data format 8-63
   Different points between RS-232C and GPIB 8-64
   Panel control 8-64
   Example of the remote control 8-65
   Error message 8-66
   Change for other options 8-68

Chapter 9 IN ABNORMALITIES

1. Inspection and Simple Troubleshooting 9-2

Chapter 10 OPERATION DESCRIPTION

1. Description of Operations 10-2
   Mixer Section 10-2
   IF Section 10-3
   LOG A/D Section 10-3
2. Block Diagram 10-4

Chapter 11 SPECIFICATIONS

1. R3272 Specifications 11-2
   Measurement Function 11-2
   Frequency Characteristics 11-2
   Amplitude Range 11-3
   Dynamic Range 11-3
   Amplitude Accuracy 11-5
   Analog Demodulation 11-6
   Input/Output 11-6
   General Specifications 11-8

APPENDIX

1. Glossary A-2
2. dB Conversion Formulas A-7
3. Menu Lists A-8
4. Restriction on the IC Card A-18
   Usable Cards A-18
   Disusable Cards A-18
5. List of Messages A-19

DIMENSIONAL OUTLINE DRAWING EXT-1

ALPHABETICAL INDEX I-1

LIST OF ILLUSTRATIONS

No.	Title	Page
1-1	Operating Conditions	1-3
1-2	Environmental Conditions	1-4
3-1	Connecting the Power Cable	3-2
3-2	Power Switch	3-3
3-3	Panel keys and soft keys	3-5
3-4	Displayed active area	3-7
3-5	How to set data	3-7
3-6	Annotation on the Screen	3-9
3-7	Connection for calibration	3-10
3-8	Connection for power level measurement	3-11
3-9	Power level measurement for 30 MHz CAL signal	3-12
3-10	Reference level setting	3-13
3-11	Power level measurement by increased display resolution	3-14
3-12	Connection for frequency measurement	3-15
3-13	Frequency measurement for 30 MHz CAL signal	3-16
3-14	Measurement by frequency counter	3-17
3-15	Display of maximum level at marker point	3-18
3-16	Frequency measurement in COUNTER mode	3-19
3-17	MKR⇒CF function	3-20
3-18	MKR⇒REF function	3-21
3-19	Dynamic range and sweep rate	3-22
5-1	Frequency measurement with normal marker	5-2
5-2	Frequency measurement in frequency counter mode	5-3
5-3	Measurement of AM signal	5-5
5-4	Adjusting the signal level	5-6
5-5	Measuring the period of modulated wave	5-8
5-6	Modulation frequency of AM wave	5-9
5-7	Modulation index of AM wave	5-9
5-8	Setting of central frequency	5-10
5-9	AM wave of high modulation frequency and low modulation index	5-11
5-10	Relation between sideband level-carrier level (ESB - EC) and modulation index m(%)	5-12
5-11	Measurement of FM wave	5-13

No.	Title	Page
5-12	Adjustment of signal level	5-14
5-13	Moving the marker on the peak of modulated wave	5-15
5-14	FM wave of low modulation frequency	5-16
5-15	Adjusting carrier frequency at central frequency	5-17
5-16	Carrier peaks	5-18
5-17	FM wave of high modulation frequency and low m value	5-18
5-18	Adjusting central frequency at the carrier frequency	5-19
5-19	FM wave with small Δfpeak	5-20
5-20	FM wave with large Δfpeak	5-21
5-21	fC and EC of FM wave	5-22
5-22	fSB and ESB of FM wave	5-23
5-23	Pulse modulated wave	5-24
6-1	Drive Slot for Memory Card	6-5
6-2	The Menu Screen of Save Function	6-7
6-3	The Menu Screen of the Recall Function	6-9
6-4	Printing Example in the Printing Mode "Gray"	6-14
6-5	Printing Example in the Printing Mode "Mono S"	6-14
6-6	Printing Example in the Printing Mode "Mono L"	6-15
6-7	Printing Example in the Menu Print "OFF"	6-15
7-1	Functions of Fundamental Keys on the Front Panel	7-2
7-2	Center Frequency Display	7-2
7-3	Start/Stop Frequency	7-3
7-4	Frequency Span	7-5
7-5	Reference Level	7-7
7-6	RBW : Maximum IF Bandwidth which can be Divided into Two Signals	7-10
7-7	VBW = 300 kHz	7-11
7-8	VBW = 3 kHz	7-11
7-9	FORMAT Key on the Front Panel	7-20
7-10	Write Mode and View Mode	7-22
7-11	No Averaging	7-23
7-12	After Averaging 20 Times	7-23
7-13	Label Input Screen	7-31
7-14	MARKER Section Key on the Front Panel	7-32
7-15	Next Peak Search Execution	7-35

No.	Title	Page
7-16	△Y Setting	7-36
7-17	In the Case of Up Setting	7-37
7-18	In the Case of Low Setting	7-37
7-19	MARKER Section Key on the Front Panel	7-45
7-20	Trigger is made at the waveform being displayed	7-49
7-21	SWP = AUTO (500 ms)	7-50
7-22	SWP = 50 ms	7-50
7-23	Panel Keys in MEASUREMENT Section	7-52
7-24	Displayed drive list	7-65
7-25	Displayed drive list	7-66
7-26	Displayed drive list	7-69
7-27	Displayed drive list	7-73
7-28	Setting the date and time	7-79
8-1	Relation between screen grid and trace data	8-48
8-2	Selected window of serial port (OPT15 are already installed)	8-60
8-3	Parameter setup	8-61
8-4	Connection of the controller and Spectrum Analyzer	8-62
8-5	Cable wiring diagram	8-62
8-6	Data format	8-63
10-1	Block Diagram	10-4
A-1	Bandwidth Switching Accuracy	A-2
A-2	IF Bandwidth	A-3
A-3	Noise Sideband	A-3
A-4	Occupied Bandwidth	A-4
A-5	Reference Level	A-4
A-6	Bandwidth Selectivity	A-5
A-7	Spurious Response	A-5
A-8	VSWR	A-6

LIST OF TABLES

No.	Title	Page
1-2	Power Supply Specifications	1-5
4-1	Warm-up time for built-in reference quarts oscillator	4-2
6-1	Memory Card Specifications	6-3
6-2	Recommended Printer	6-12
6-3	Printer Output Format	6-13
6-4	Operation tested plotters by ADVANTEST	6-17
6-5	Plotter paper size	6-20
6-6	Assignment of the plotter pen	6-20
6-7	File extension	6-22
6-8	Output File Size	6-23
7-1	Display Resolution of Center Frequency	7-3
7-2	Display Resolution of Frequency Span	7-5
7-3	Range of Frequency Bandwidth forExternal Mixer	7-15

CHAPTER 1

INTRODUCTION

This chapter gives a brief explanation of product, its working environment and operational precautions. Read this chapter before you use the product.

CONTENTS

1. Outline of Product 1-2
2. Operating Conditions 1-3
3. Power Source 1-5
4. Cleaning, Storage, and Transportation ... 1-9
5. Notes on Use 1-10

1. Outline of Product

R3272 is a microwave spectrum analyzer which covers the frequency range from 9 kHz to 26.5 GHz.
Advantages:

- Compact instrument weighing at only 16.5 kg (main body). Optimum for microwave circuit of repeater station or other site facility or for radio wave or spurious measurement for satellite communication.
- Simple operation achieved by the independent keys for measuring occupied bandwidth (OBW), adjacent channel leak power (ACP) and harmonic distortion (HARM).
- Highly stable sweep in narrow band ($\leqq$5 MHz) achieved by DDS (direct digital synthesizer) technology.
- Easy of display viewing are improved by introducing 6.5-inch TFT color liquid crystal display.

2. Operating Conditions

■ Operating environmental conditions

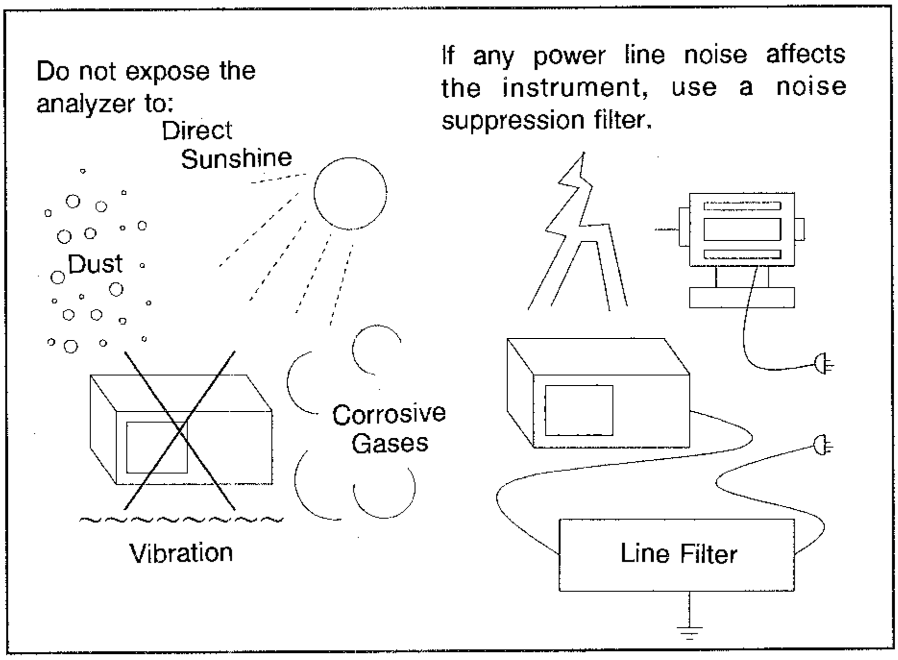


Figure 1-1 Operating Conditions

- Environmental temperature:
  0°C to +50°C (Operating temperature range)
  -20°C to +60°C (Storage temperature range)
- Relative humidity: RH85% or less (Non-condensing)
- Place without corrosive gases
- Place without exposed to direct sunshine
- Place without dust
- Place without vibration
- Place where there is minimum noise

The instrument is designed to resist noise from AC power lines. However, you should still take steps to minimize power line noise. If necessary, install a noise suppression filter.

For highly accurate measurement, turn the power ON after the instrument temperature has reached the room temperature level, and warm up the instrument for 60 minutes.

Installation

Air cooling fan of the exhaust type is built into the rear panel. Do not close this outlet.

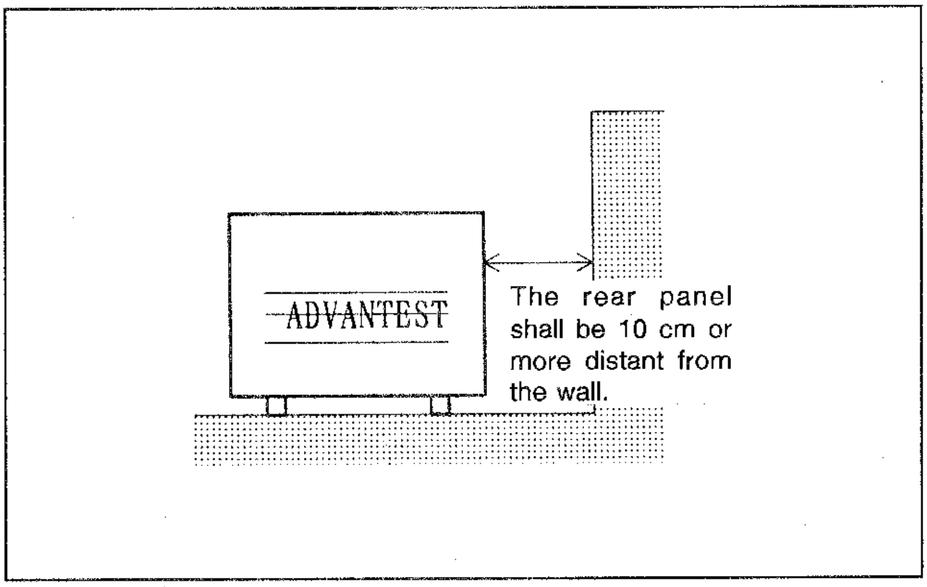


Figure 1-2 Environmental Conditions

3. Power Source

■ Checking Power Requirements

WARNING !
Safely use R3272 according to the power requirement.
R3272 might be damaged to the case not following the power requirement.

The power requirement of R3272 is shown in the following.

Table 1-2 Power Supply Specifications

	$100V_{AC}$ operation	$220V_{AC}$ operation
Input voltage range	90 V to 132 V	198 V to 250 V
Frequency range	48 Hz to 66 Hz	48 Hz to 66 Hz
Power Fuse	T6.3A/250V	
Power consumption	300VA or below	

■ Changing the supply voltage

The supply voltage of this device is automatically changed over (100/240 V). Be sure to use a power cable which matches the supply voltage and conforms to the related standard.

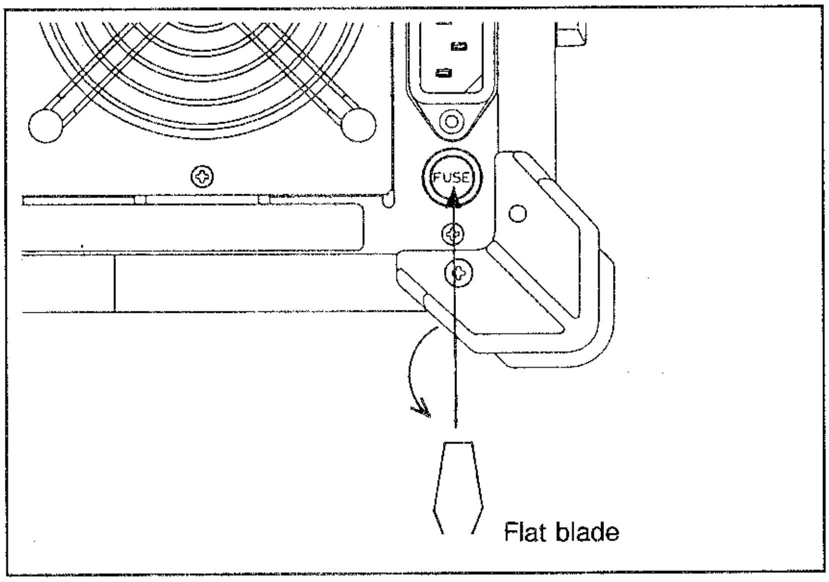
Replacing the power fuse

WARNING !

1. ***Before replacing the power fuse, be sure to turn the power switch OFF and remove the power cable from the outlet.***
2. ***For continued protection against fire hazard, use a fuse of the type and rating which match the supply voltage.***

Power fuse is accommodated in the FUSE holder on the rear panel.
To check or replace the power fuse, observe the following procedure.

1 **With a flat blade, turn counterclockwise the cap of the FUSE holder by approximately 90 degree.**



Take the flat blade off the cap, and the FUSE holder comes out by approximately 3 mm.

2 **Pull the FUSE holder out, and replace the fuse with new one.**

Use a fuse which conforms to the following specification:

Input voltage range	Fuse
AC 90 to 132 V	T6.3 A/250 V
AC 198 to 250 V	T6.3 A/250 V

3 **After replacing the fuse, re-insert the FUSE holder, slightly push it by a flat blade and turn it clockwise by approximately 90 degree to put it in position.**

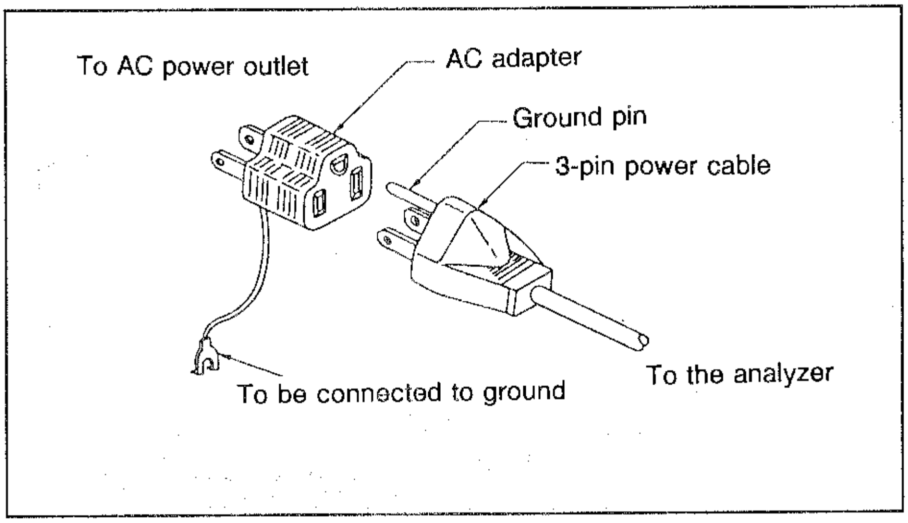
Connecting the Power Cable

WARNING !

1. *Power cable*
   - ***Use power cable of the attachment for the electric shock and the fire prevention.***
   - ***Use power cable in accordance with the safety standard of the country for use excluding Japan.***
   - ***When you connect power cable with the outlet, turn off the power switch.***
   - ***When you pull out power cable from the outlet, have the plug.***

2. *Protective earth*
   - ***Connect the power plug cable with the power outlet which has the protective earth terminal.***
   - ***If the code for the extension without the protective earth terminal is used, the protective earth will become invalid.***
   - ***Case in which use of AC adapter (Three pins to two pins conversion adapter), the earth pin of the adapter is grounded to the earth of the outlet, or connect ground terminal of the rear panel with the earth of the outside, and ground it to the earth.***

(1) A three-pin power connector is insufficient for Japan, so a 3-pin-to-2-pin adapter is provided. It is extremely important when using this adapter for connection to a power outlet to ground the ground pin extending from the adapter.



(2) AC power cable for overseas use
Information of AC power cable for overseas use is shown on page Plug-1*.

4. Cleaning, Storage, and Transportation

■ Cleaning

Wipe any dirt of R3272 off with a soft cloth (or damp cloth). Attend to the following points.

- Do not remain the fluff of the cloth and do not soak water into the internal of R3272.
- Do not use an organic solvent (for example, benzene and acetone, etc.) which changes plastics in quality.

■ Storage

Storage temperature of this instrument is from -20 to +60 degrees C. Do not store it out of this temperature range.
In case that in which R3272 is not used for a long time, cover with the vinyl cover or put in the cardboard box and prevent dust. Keep it in a dry place where dust and direct sunshine were prevented.

■ Transportation

When you transport R3272, pack it to packing material.

Packing procedure

1. **Wrap R3272 itself with cushion material and put in the cardboard box.**
2. **After putting attachment, put cushion again.**
3. **Shut the lid of the cardboard box. Fix the outside with string or tape.**

● **To carry the instrument by hand**
To carry the instrument by hand, put it in a transit case.
The transit case is prepared as optional accessory.

5. Notes on Use

■ Case that abnormality occurs

When smoke rises from R3272, turn off the power switch. Pull out from the outlet. And contact to our company.
The address and the telephone number of our company are in the end of this manual.

■ Warm up

After the instrument temperature has reached the room temperature level, turn the power switch ON and warm it up for 60 minutes.

CHAPTER 2

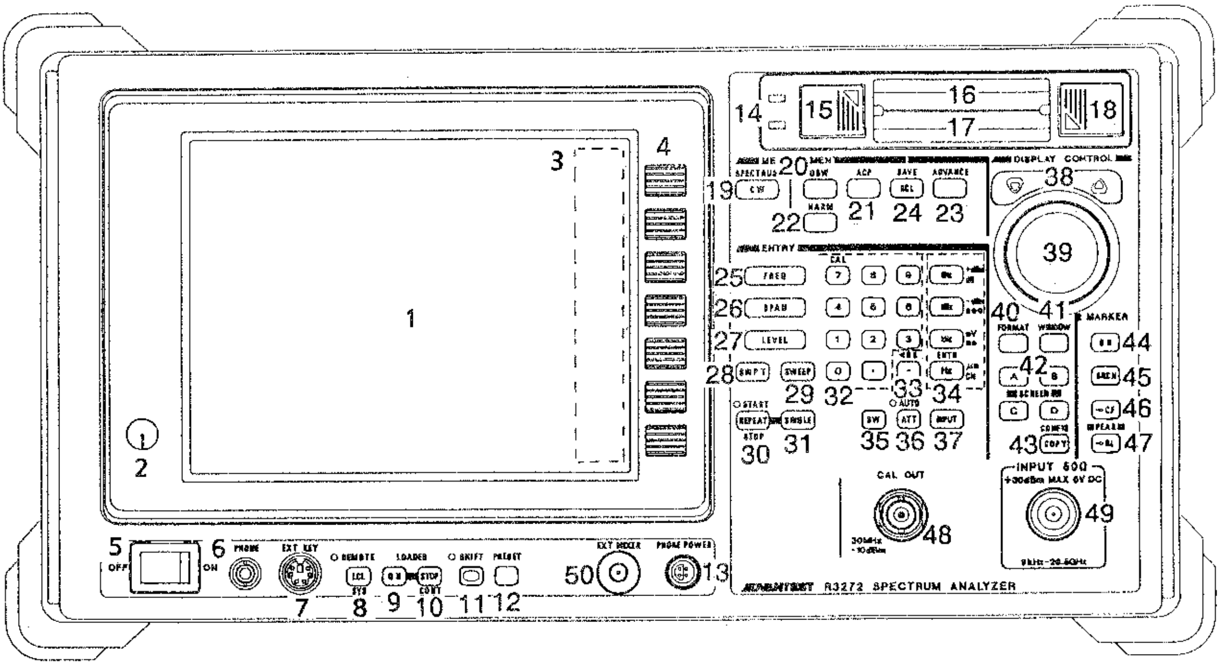
Description of Front and Rear Panels

This chapter briefly explains each section on the front and rear panels.

CONTENTS

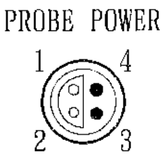
1. Description of the Front Panel 2-2
2. Description of the Rear Panel 2-7

1. Description of the Front Panel



1	Liquid crystal display (LCD)	:	Displays waveform and measured data by color. The whole display can be tilted.
			CAUTION ! ***When this instrument is used in long hours at high temperature, a blurred section may arise on the LCD display. This problem comes from not a failure of the LCD display.*** ***If this problem arises, turn off the power and turn on that.*** ***The problem is solved.***
2	INTENSITY control	:	Used to adjust the intensity of display (adjustable in the range from approximately 70% to maximum intensity).
3	Soft menu display section	:	Maximum 7 items can be displayed.
4	Soft-key	:	7 soft-keys are prepared, which correspond to the software menu display on the left.
5	Power switch	:	To turn the power ON/OFF.
6	PHONE connector	:	8-ohm earphone terminal to output AM or FM demodulated voice.

7	EXT KEY connector	:	Used to connect to an external keyboard (option 15).
8	LCL key	:	Used to cancel external control (while the REMOTE lamp is lighting).
	SYS key	:	Used to set system functions (in LOCAL mode).
	REMOTE lamp	:	Lights up in REMOTE mode.
9	CNTRLR key	:	Used to enter a control function (option 15).
10	CNTRLR STOP key	:	Used to start/stop a control function (option 15).
11	SHIFT key	:	Used to select SHIFT mode (expanded function). When selected, the LED lights up.
12	PRESET key	:	Used to initialize the panel setting.
13	PROBE POWER	:	Power supply for accessories, such as active probe.



1 : NC
2 : GND
3 : -15V
4 : +15V

14	Drive A/B lamp	:	Lights up while a memory card is being used.
15	Eject button for drive B	:	Eject button for the memory card which is set in drive B. When pressed, the memory card can be taken out of drive B.
16	Memory card inserting slot for drive B		
17	Memory card inserting slot for drive A		
18	Eject button for drive A	:	Eject button for the memory card which is set in drive A. When pressed, the memory card can be taken out of drive A.

MEASUREMENT Section

19	CW key	: Used to analyze spectrum of continuous waveform.
20	OBW key	: Used to measure occupied bandwidth.
21	ACP key	: Used to measure leak power from adjacent channel.
22	HARM key	: Used to measure harmonic distortion.
23	ADVANCE key	: Used to test the transmitter or automatically execute basic measurement (option 15).
24	RCL key	: Used to call the set conditions and waveform which are stored in the backup memory or a memory card.
	SAVE key (SHIFT + RCL)	: Used to save the currently set conditions or waveform.

ENTRY Section

25	FREQ key	: Used to select Center Frequency Input mode.
26	SPAN key	: Used to select Frequency Span Input mode.
27	LEVEL key	: Used to select Reference Level Input mode.
28	SWP T key	: Used to set sweep time.
29	SWEEP key	: Used to set sweep mode and trigger.
30	REPEAT key	: Used to execute Continuously automatic measurement or sweep.
31	SINGLE key	: Used to execute automatic measurement with one sweep only.
32	Ten-key (expanded function keys)	: Includes numeric keys (0 to 9) and a decimal point key. Can perform expanded functions when pressed together with SHIFT key.
	CAL key (SHIFT + 7)	: Used to calibrate the instrument.

33 B.S key : Used to correct the data input with ten-key or to input minus (-) sign.

34 Unit key : Used to select or set unit.

GHz key : Used to input data by GHz, dBm or dB.

MHz key : Used to input data by MHz, -dBm or sec.

kHz key : Used to input data by kHz, mV or msec.

Hz key : Used to input data by Hz or μs, for channel designation, or as ENTER key.

35 BW key : Used to set RBW and VBW.

36 ATT key : Used to set the input attenuator.

37 INPUT key : Used to set transducer factors.

DISPLAY CONTROL Section

38 Step key : Used to input data by step.

39 Data knob : Used to finely adjust input data.

40 FORMAT key : Used to set trace mode, display line and limit line or to input label.

41 WINDOW key : Used to set measuring window or multi-window.

42 SCREEN key : Used to select the active display on split screen.

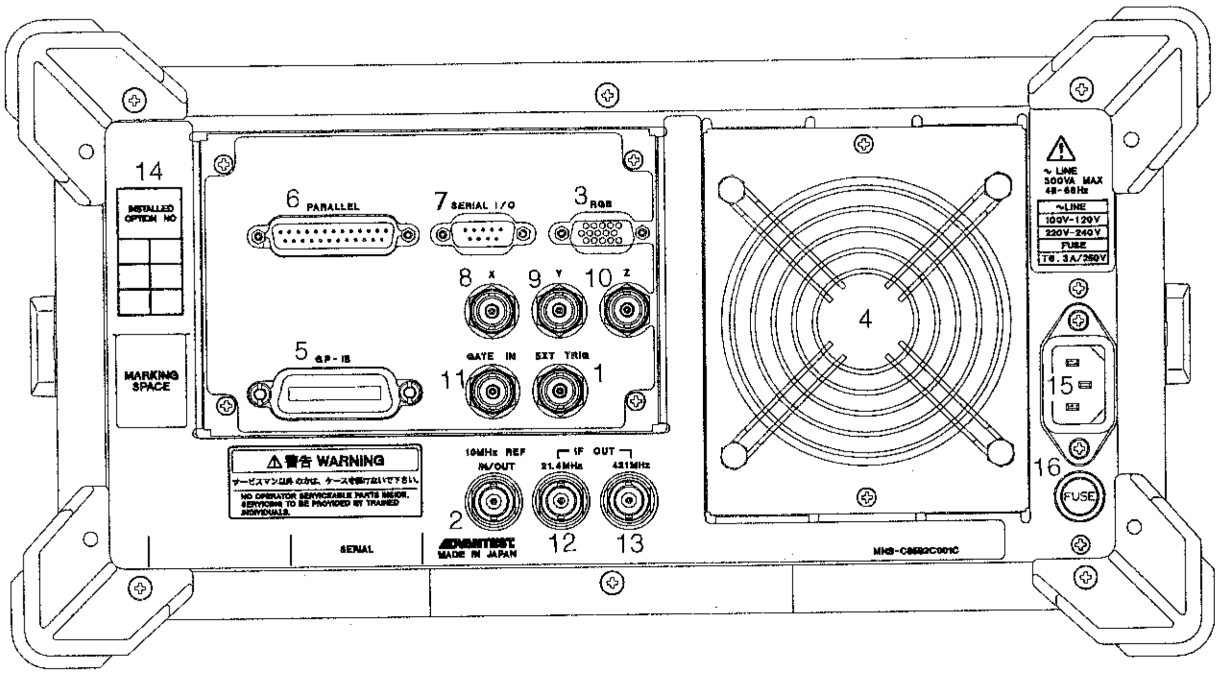
43 COPY key : Used to output wave form to a printer, plotter and the file.

CONFIG key (SHIFT + COPY) : Used to set the conditions for a printer, plotter and the file output.

MARKER Section

44	ON key	:	Used to display a marker.
45	SRCH key	:	Used to search the peak point.
46	⇒CF key	:	Used to set frequency to the center frequency of the maximum level of displayed waveform.
47	⇒RL key	:	Used to set reference level to the maximum level of the waveform displayed.
48	CAL OUT connector	:	Outputs level calibration signal, which is used for automatic calibration.
49	INPUT connector	:	50-ohm N-type input connector. Can analyze the signal of maximum input level +30 dBm, 0 VDCmax in the frequency range from 9 kHz to 26.5 GHz.
50	EXT MIXER connector	:	Connector for external mixer.

2. Description of the Rear Panel



1 External trigger input terminal

: External trigger and gate input.
Start sweep by positive going and negative going pulse (selectable) of TTL level.
This can be used for the gate signal input for gated sweep.

2 10 MHz reference frequency signal I/O terminal

: I/O terminal for 10 MHz reference frequency signal

Input impedance	:	Approx. 50 ohm
Input level	:	-5 to +5 dBm
Output level	:	Approx. 0 dBm

3 Video output terminal : RGB signal output equivalent to VGA (640 x 480)

4 Cooling fan : Exhaust cooling fan.

5 GPIB connector : Connector for GPIB cable from external controller or plotter.

6 PIO connector : Connector for Centronics printer.

7 RS-232 connector : Connector for external controller which is used to execute remote control via RS-232 interface.

8 X output terminal : Outputs approx. -5 to +5 V ramp voltage proportional to sweep.
Output impedance : Approx. 1k ohm

9 Y output terminal : Outputs video signal with detection in proportion to CRT trace vertical deflection.
Output voltage : approx. 0 to 2 V (10dB / DIV)
approx. -3 to 5 V
Output impedance : approx. 220 ohm

10 Z output terminal : Outputs +5 V (TTL High level) when the spectrum analyzer is executing sweep, while 0 V (TTL Low level) when blanking.

11 Gate sweep control terminal : Stops sweep and measurement when TTL Lo level, and executes sweep and measurement when TTL Hi level.

12 21.4 MHz IF OUT : Outputs final IF (21.4 MHz) signal.
Bandwidth : Set resolution bandwidth
Output level : Approx. -15 dBm for the full scale on CRT
Output impedance : approx. 50 ohm

13 421.4 MHz IF OUT : Outputs 2nd IF (421.4 MHz) signal.
Output impedance : approx. 50 ohm

14 Indication for built-in option devices

15 AC power connector : 3-pin connector. Center pin is for grounding.

16 FUSE holder : Accommodates a power line fuse.

CHAPTER 3

Fundamental Operation

This chapter explains the fundamental operation for those who use this instrument for the first time.

CONTENTS

1. Initial power-on 3-2
2. Operation keys 3-5
3. Annotation on the screen 3-9
4. Calibration 3-10
5. Measuring the power level 3-11
6. Measurement of Frequency 3-15
7. Dynamic Range and Sweep Rate 3-22

1. Initial power-on

■ Connecting to AC power source

1 With the instrument's power switch turned **OFF**, connect the attached power cable to the AC power connector on the rear panel.

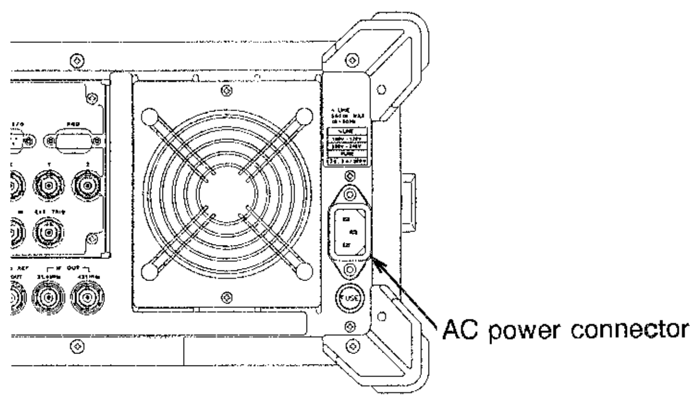


Figure 3-1 Connecting the Power Cable

2 Connect another end of the power cable to an outlet.

WARNING !
Connecting to an out-of-spec power source may damage this instrument. Power specification of this instrument is as follows:

	Operation under 100 V_{AC}	Operation under 220 V_{AC}
Input voltage	90 to 132 V	198 to 250 V
Frequency	48 to 66 Hz	48 to 66 Hz

■ Power-on

After connecting the power cable, turn ON the power switch on the front panel.

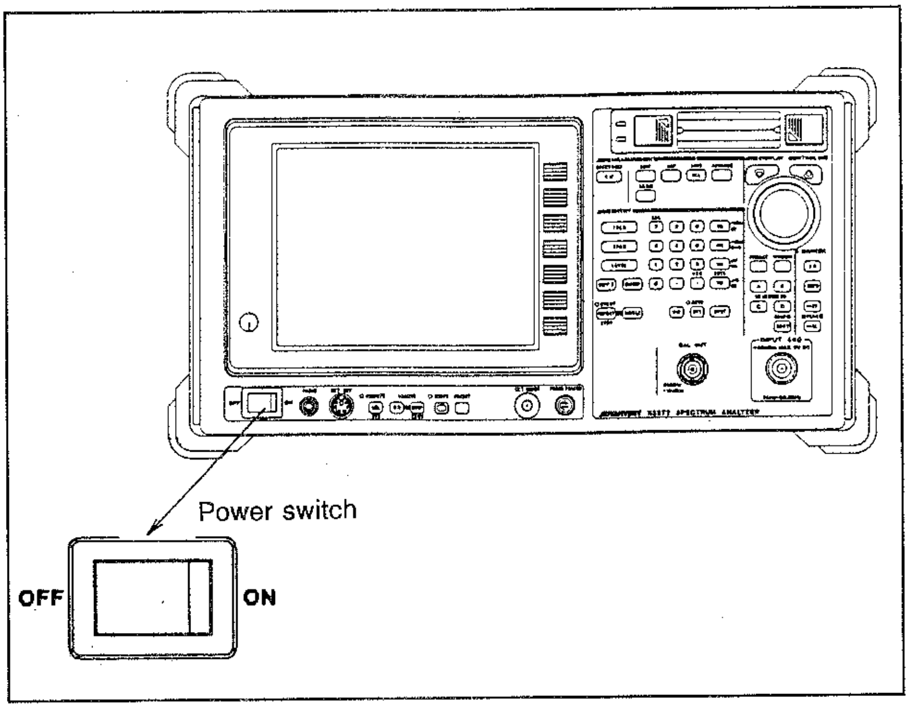
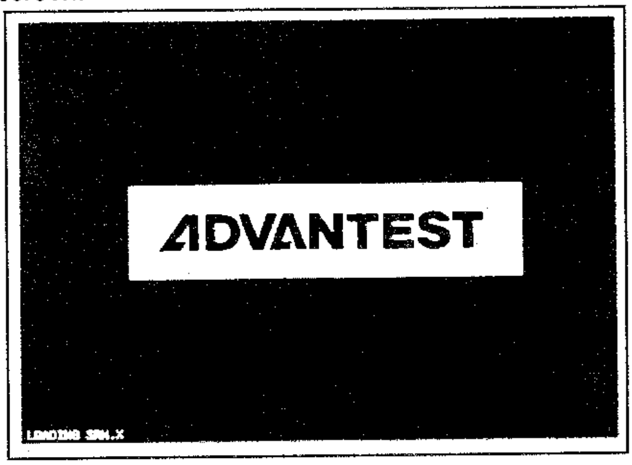
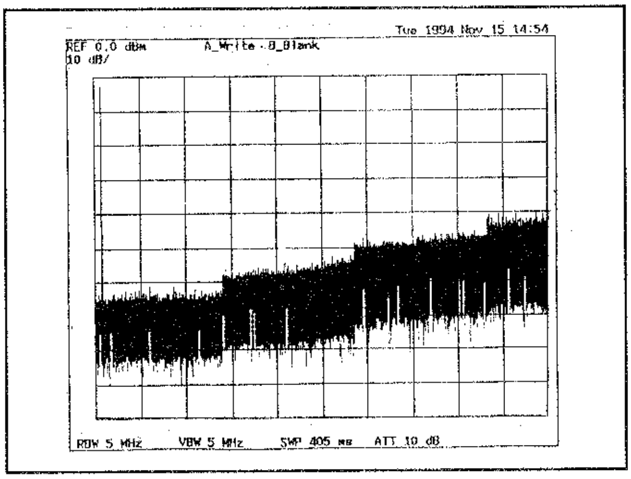


Figure 3-2 Power Switch

When the power switch is turned ON, the following screen appears on the LCD. A few seconds later, the screen changes to the initial setting screen.



"ADVANTEST" is displayed at the center of screen. (While this is displayed, self checking is executed.



Initialization screen after shipment

When the instrument is used for the first time after shipment, the screen shown on the above appears. In general, previously set conditions are backed up, and a waveform under such conditions is displayed when the power switch is turned ON.

To reset to the initial setting at shipment, press SHIFT and PRESET keys.

CAUTION !

The contents of the PRESET can be changed by the function of the saving.

Default IP: The initial setting at shipment.

Save REG#IP: Saves the present set condition.

2. Operation keys

■ Panel keys and soft keys

This instrument is operated with panel keys and soft keys.

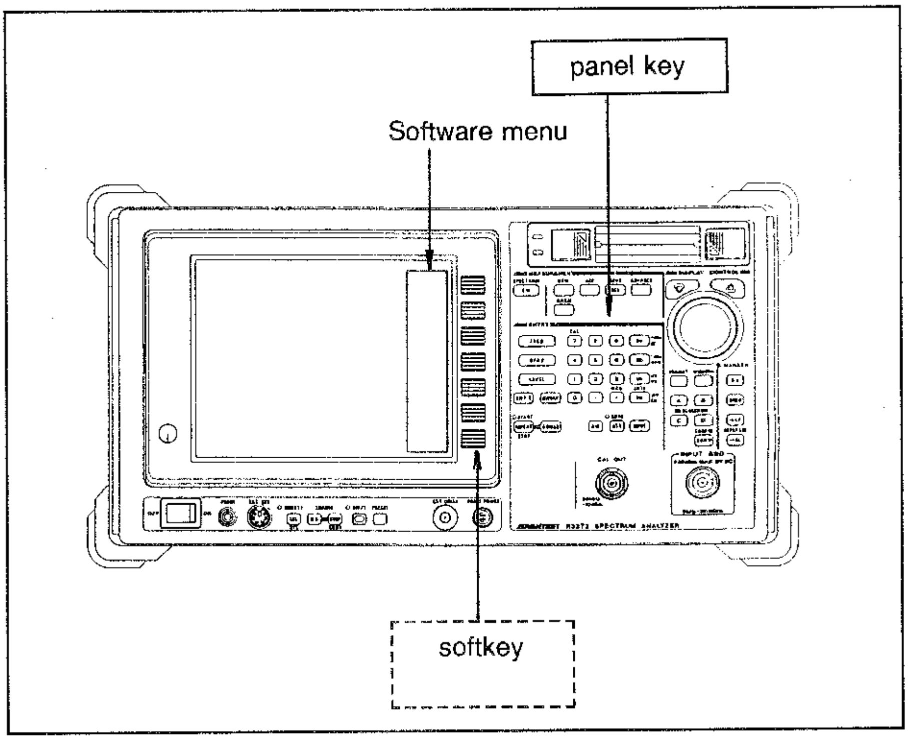
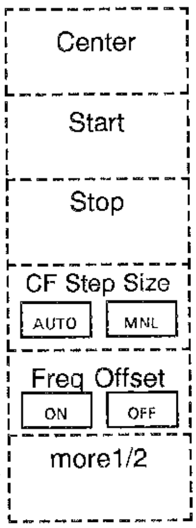


Figure 3-3 Panel keys and soft keys

Pressing a panel key displays a software menu at right on the screen.

Press a soft key, and the corresponding function in the software menu will be displayed.

Press FREQ panel key, which is used to set center frequency, and the following software menu appears at right in the display.



The software menu for FREQ includes 6 items as shown in the figure at left.
The remaining one item is currently not used and kept blank.

Furthermore, the key in the software menu appeared in the red frame ("Center" in FREQ at the initial condition) is shown in the active condition that the setting can be changed.

- **Function of SHIFT key**

To execute the functions marked in blue above the panel keys, press SHIFT key together with the corresponding key.

Pressing SHIFT key lights up the LED at upper left.

Example : To select calibration function.
Press SHIFT and CAL 7 keys.

● **Data setting**

When a panel key and a soft key is pressed to set data, the function of the pressed key and the current set conditions are displayed at upper left on the screen. This display area is called "active area". Set data, checking the values displayed in the active area.

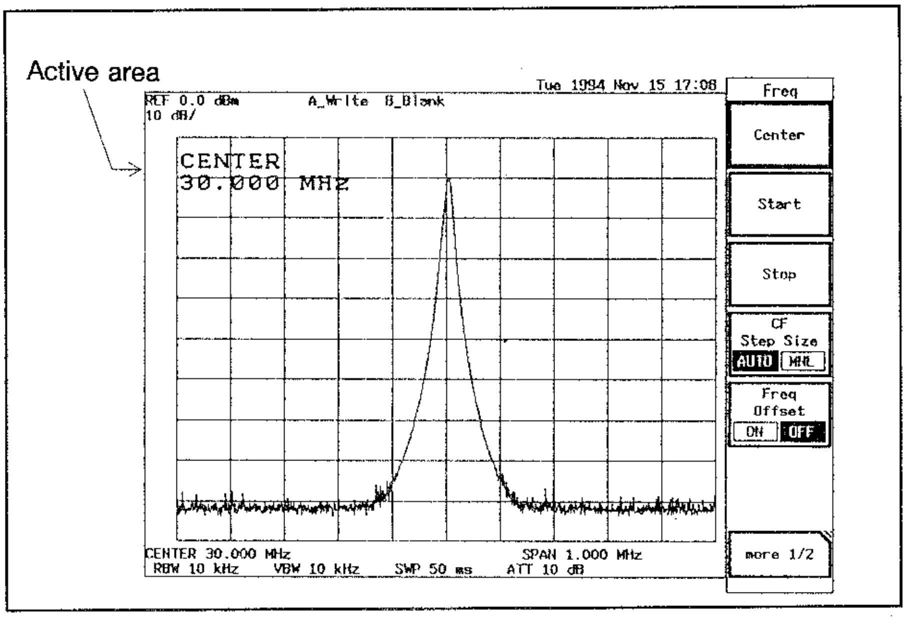


Figure 3-4 Displayed active area

There are 3 methods for setting data.

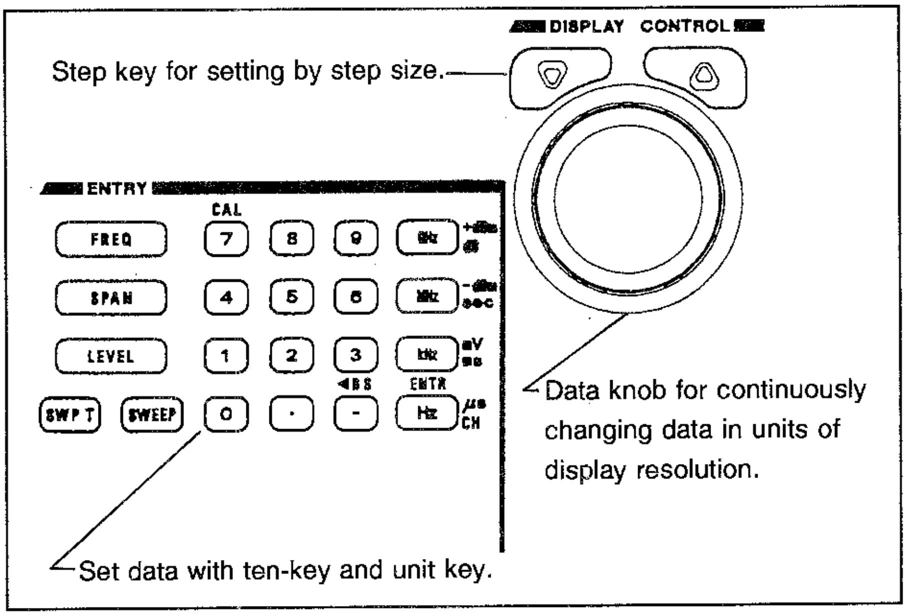


Figure 3-5 How to set data

○ **Ten-key and unit key**

These keys are used to input numeric data.
Input a numeric value with ten-key, and press a unit key.

To execute a function marked in blue above the numeric keys, use "SHIFT" key.

Pressing B.S [-] key deletes the rightmost digit of the numeric value which has been input with ten-key. This key is useful for correcting input data. When no data is input, pressing B.S [-] key inputs "-(minus)" sign.

○ **Step key and data knob**

Step key is used to set data by predefined step size.
Pressing [▽] key decrements the data, while pressing [△] key increments the data.
Data knob is used to set data in units of predefined display resolution. It is very convenient for finely adjusting set data.
When pressed in label mode or setting data, it functions as ENTER key.

○ **Dialog Box (Setting Menu), Error/Warning Message**

The dialog box that is displayed to set the date or to select the printing output or the error/warning message that is not erased automatically after the specified time is cleared by pushing a panel key.

3. Annotation on the screen

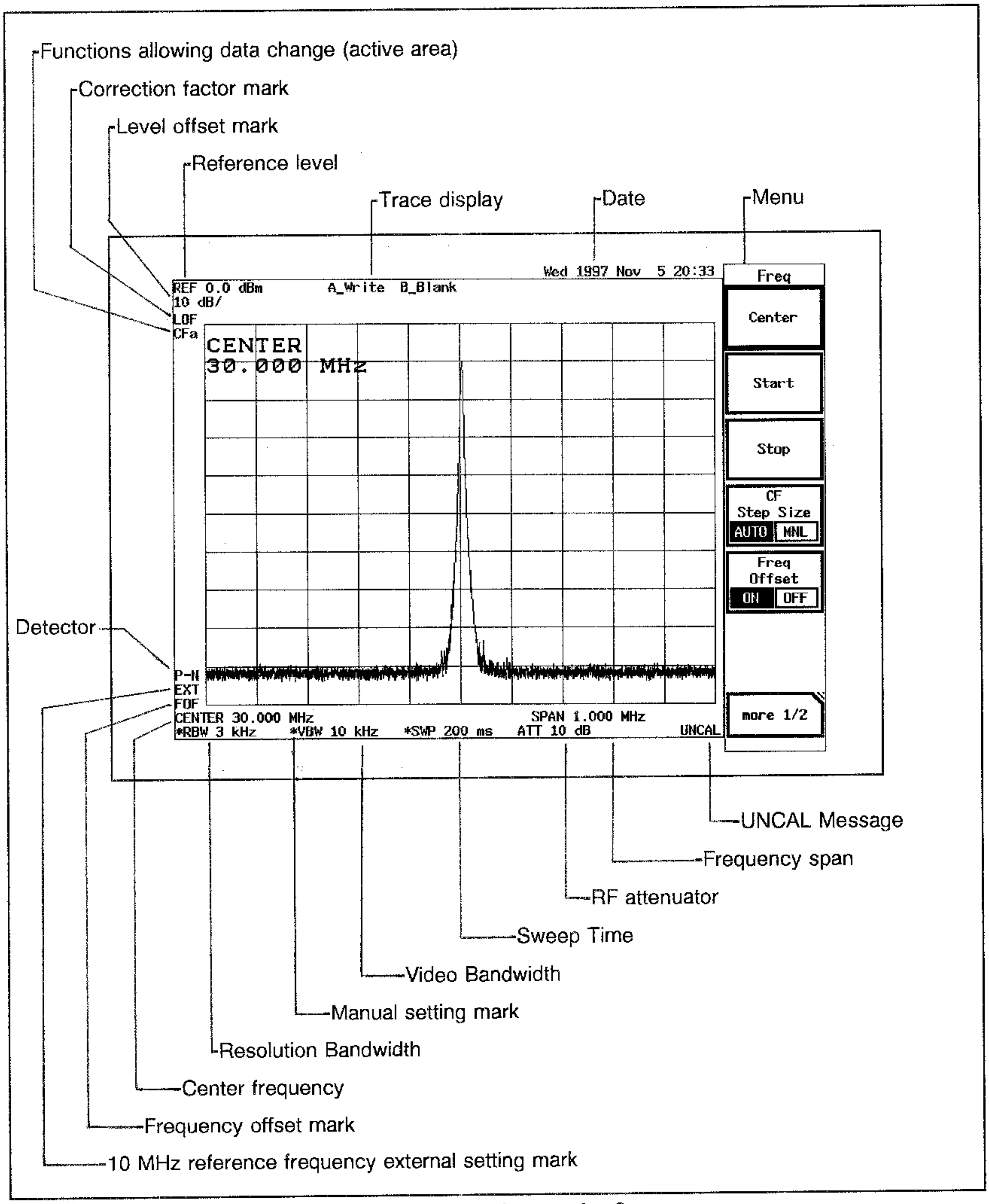


Figure 3-6 Annotation on the Screen

4. Calibration

To execute measurement at specified accuracy, warm up the instrument for more than 60 minutes after the power has been turned on.

1 **Connect the N-BNC adapter to the INPUT connector on the front panel.**

2 **Connect CAL OUT and INPUT connectors on the front panel with the BNC cable (MC-61).**

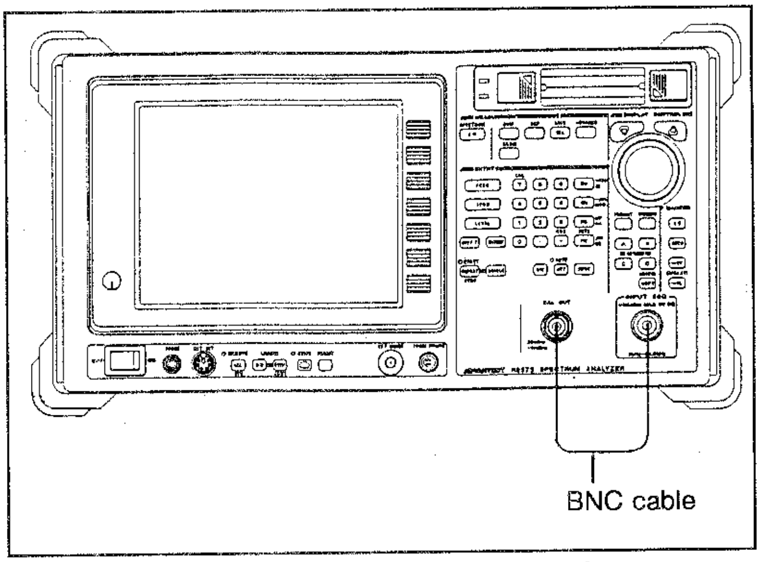


Figure 3-7 Connection for calibration

3 **Press** SHIFT [●] **,** CAL [7] **and** [CAL All] **keys to execute calibration.**

It takes approximately 8 minutes until calibration is completed.

CAUTION !
Sometimes, there is a noise of switching in the instrument on executing the calibration. This is the noise that switches the RF attenuator.

5. Measuring the power level

1 Press SHIFT [ ] and PRESET [ ] keys to reset to initial setting.

2 Connect the N-BNC adapter to the INPUT connector on the front panel.

3 Connect CAL OUT and INPUT connectors on the front panel with the BNC cable (MC-61).

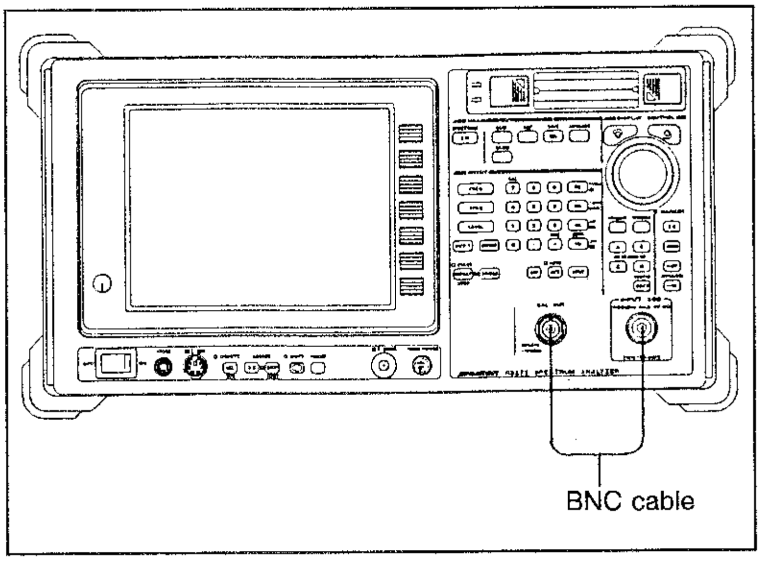


Figure 3-8 Connection for power level measurement

4 Press [LEVEL], [0] and [GHz] (+dBm / sec) keys to set reference level to 0 dBm.

5 Press [FREQ], [3], [0] and [MHz] keys to set center frequency to 30 MHz.

6 **Press** [SPAN] , [5] **and** [MHz] **keys to set frequency span to 5 MHz.**

7 **Press** [SRCH] **key to display a marker at the maximum level on the screen.**

The level at marker position is displayed at upper right on the screen.

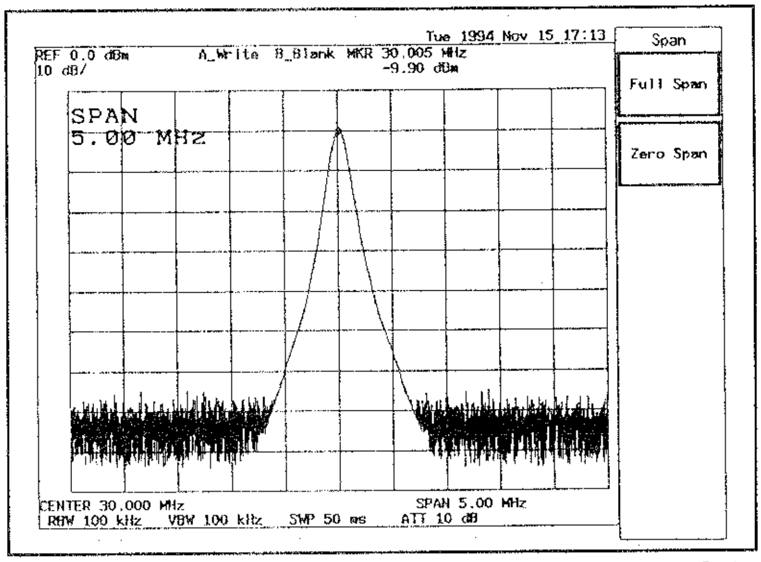


Figure 3-9 Power level measurement for 30 MHz CAL signal

● **Power level measurement by increased display resolution**

1 **Press** ⇒RL **key to set marker level to reference level.**

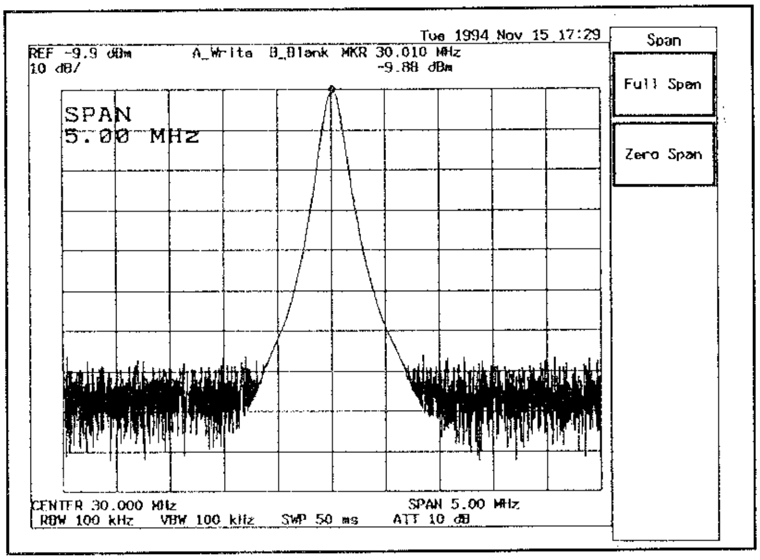


Figure 3-10 Reference level setting

2 **Press** LEVEL , dB/div **and** 1dB/div **keys.**

3 **Press** SPAN , 1 **and** MHz **keys to set frequency span to 1 MHz.**

4 **Press** BW , RBW (AUTO MNL) , 3 , 0 , 0 **and** kHz **keys to set RBW to 300 kHz.**

5 **Press** VBW (AUTO MNL) , 3 , 0 **and** kHz **keys to set VBW to 30 kHz.**

In the case that the displayed level is changed by the changing of RBW at this time, press ⇒RL again to set to the reference level.

6 **Press SRCH key to display a marker at the maximum level on the screen.**

The power level at the marker position is displayed at upper right on the screen.

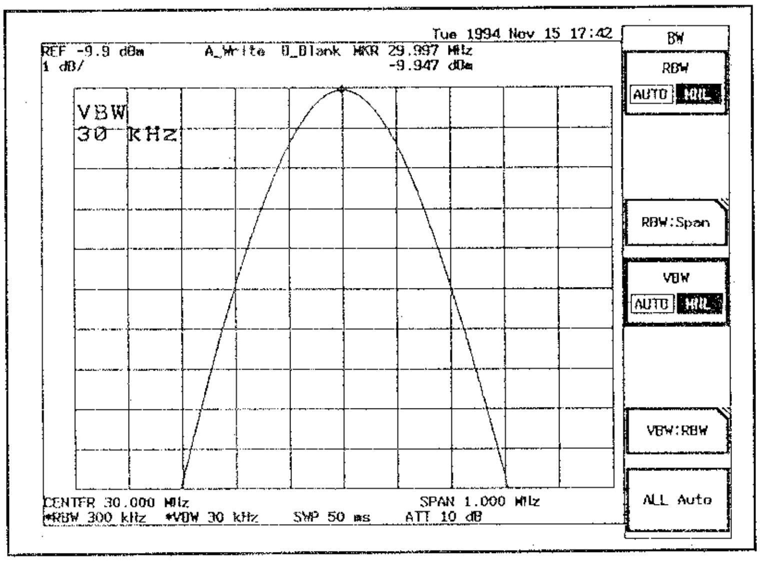


Figure 3-11 Power level measurement by increased display resolution

6. Measurement of Frequency

■ Measurement with normal marker

1 Press [SHIFT] and [PRESET] keys to reset to initial setting.

2 Connect the N-BNC adapter to the INPUT connector on the front panel.

3 Connect CAL OUT and INPUT connectors on the front panel with the BNC cable (MC-61).

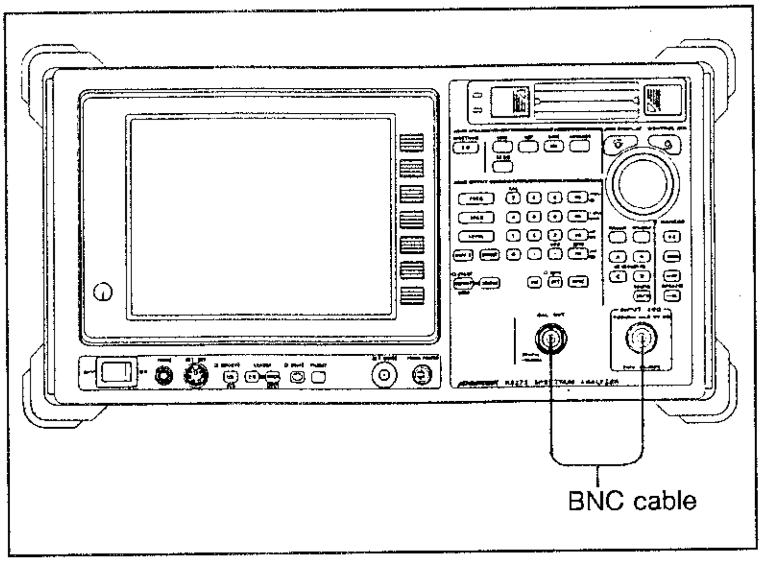


Figure 3-12 Connection for frequency measurement

4 Press [LEVEL], [0] and [GHz +dBm sec] keys to set reference level to 0 dBm.

5 Press [FREQ], [3], [0] and [MHz] keys to set center frequency to 30 MHz.

6 **Press** SPAN **,** 5 **and** MHz **keys to set frequency span to 5 MHz.**

7 **Press** SRCH **key to display a marker at the maximum level on the screen.**

The frequency at marker position is displayed at upper right on the screen.

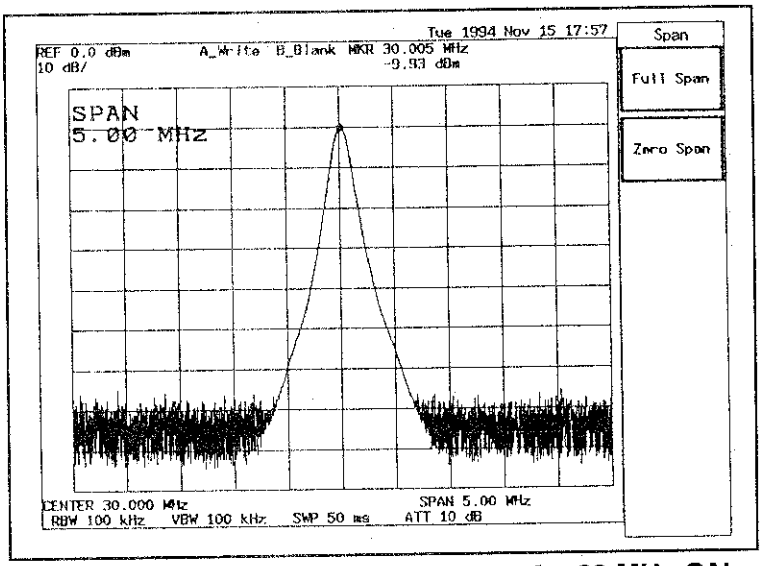


Figure 3-13 Frequency measurement for 30 MHz CAL signal

Measurement by frequency counter

For continuous carrier signal, frequency can accurately be measured in COUNTER mode.
When frequency is measured with normal marker, the measured data corresponds to the position at which the marker is displayed and includes errors related to span accuracy, display resolution, etc.
In COUNTER mode frequency of the signal is measured directly by the frequency counter, so that measuring accuracy is increased to the accuracy of reference source. However, when the difference in level between marker point and displayed noise level is 25 dB or less, or when SPAN value is 1 GHz or more, measurement may not be accurate.

1 **Press SHIFT and PRESET keys to reset to initial setting.**

2 **Connect the N-BNC adapter to the INPUT connector on the front panel.**

3 **Connect CAL OUT and INPUT connectors on the front panel with the BNC cable (MC-61).**

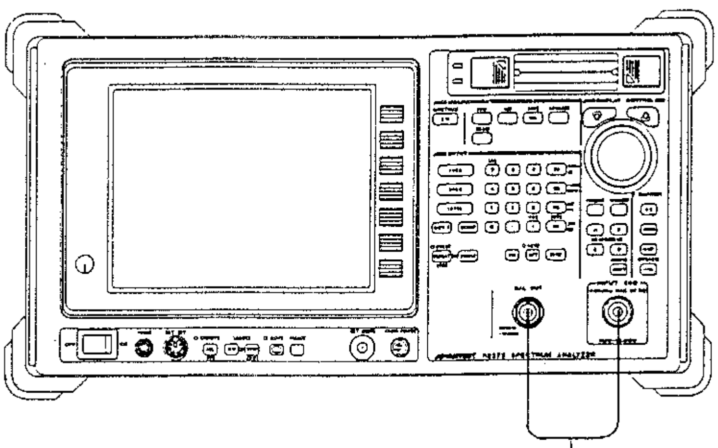


Figure 3-14 Measurement by frequency counter

4 Press [LEVEL], [B-S -], [1], [0] and [GHz +dBm sec] keys to set reference level to -10 dBm.

5 Press [FREQ], [3], [0] and [MHz] keys to set center frequency to 30 MHz.

6 Press [SPAN], [5] and [MHz] keys to set frequency span to 5 MHz.

7 Press [SRCH] key to display a marker at the maximum level on the screen.

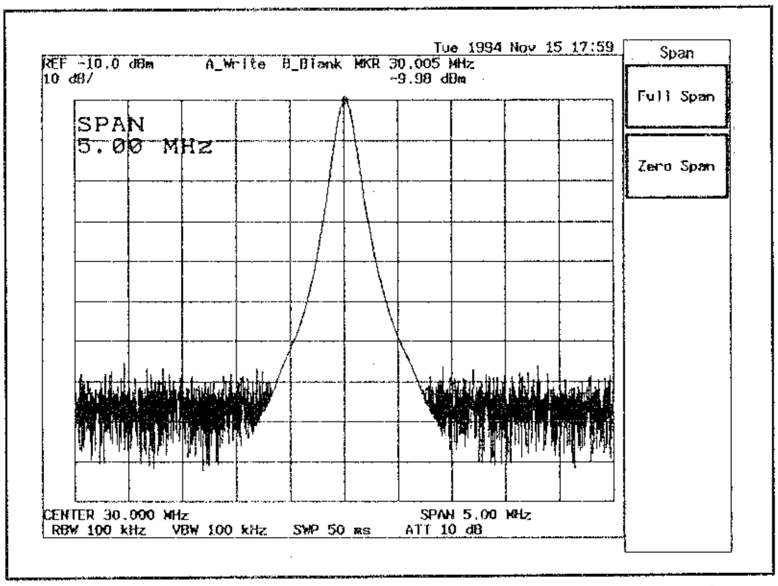


Figure 3-15 Display of maximum level at marker point

8 Press [CW], [Counter] and [Counter ON OFF] keys to set to COUNTER mode.

9

Press Resolution 1Hz **key to set counter resolution to 1 Hz.**

The frequency in MARKER mode at marker position is displayed at upper right on the screen.

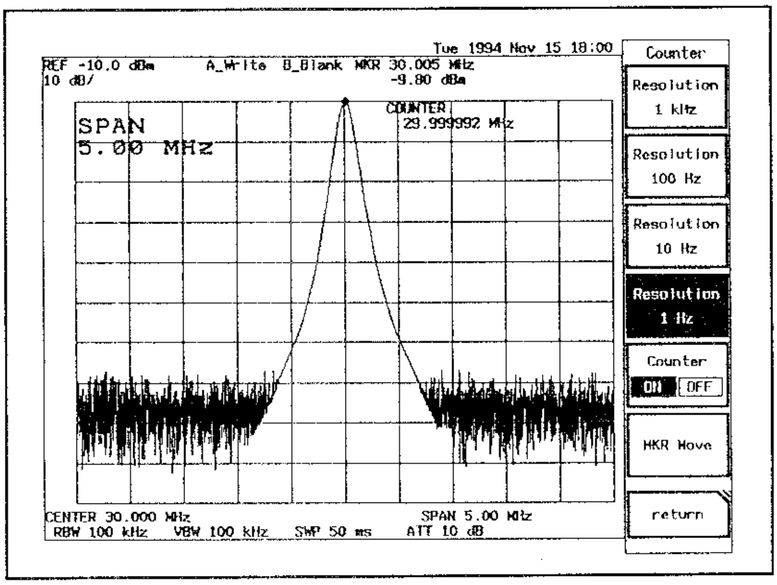


Figure 3-16 Frequency measurement in COUNTER mode

■ Convenient functions MKR⇨CF, MKR⇨REF

● **MKR⇒CF function**

This function makes the frequency at active marker position the center frequency.
It is very useful to, for example, adjust unknown frequency to center frequency.

<When peak level of waveform>

1 **Press** [⇒CF] **key.**

Then the frequency at peak level point on the screen becomes the center frequency.

<When not peak level of waveform>

1 **Press** MARKER [ON] **key, and turn the data knob to move the marker to the frequency point which is the center frequency.**

2 **Press** [more 1/3], [Marker⇒] **and** [MKR⇒CF] **keys.**

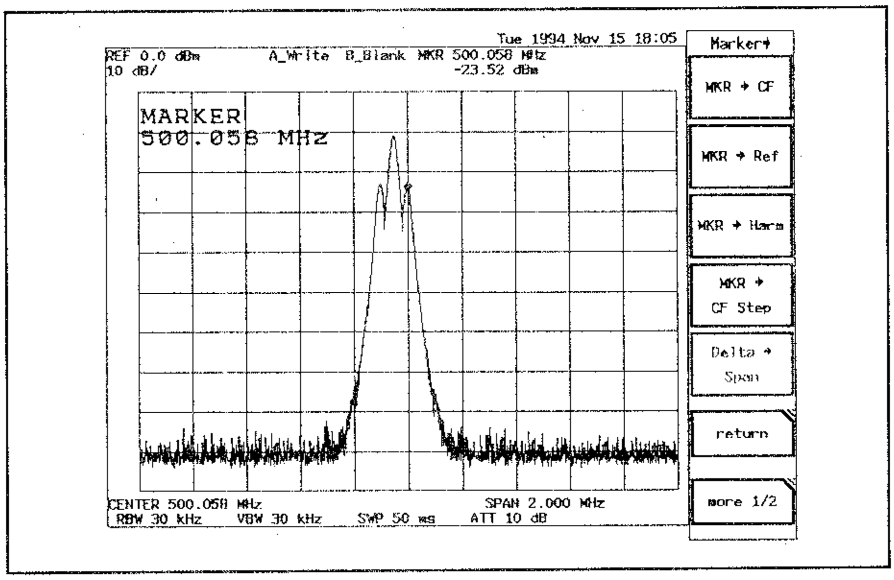


Figure 3-17 MKR⇒CF function

● MKR⇒REF function

This function makes the level at active marker position the reference level.
It is very useful to, for example, adjust the peak level of waveform to reference level.

<When peak level of waveform>

1 **Press** [⇒RL] **key.**

Then the peak level on the screen becomes the reference level.

<When not peak level of waveform>

1 **Press** MARKER [ON] **key, and turn the data knob to move the marker to the level point which is the reference level.**

2 **Press** [more 1/3], [Marker⇒] **and** [MKR⇒Ref] **keys.**

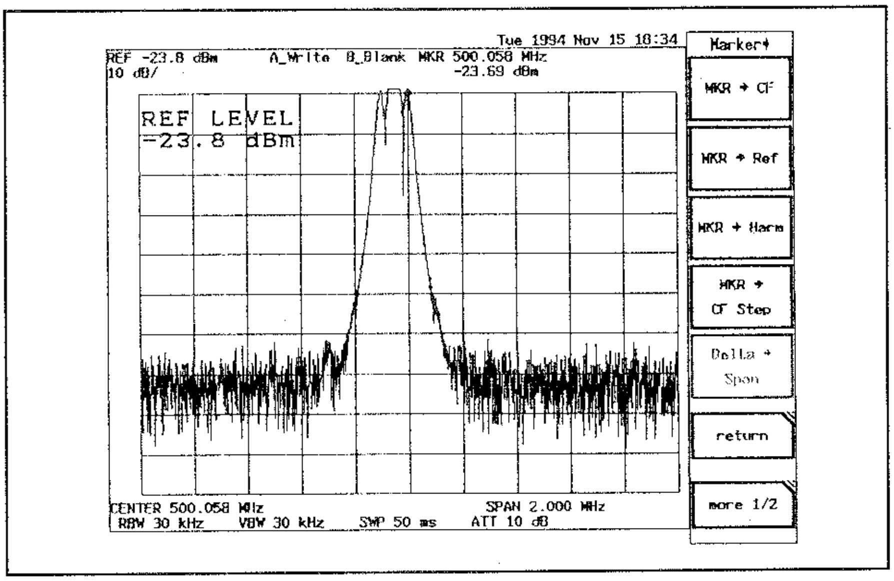


Figure 3-18 MKR⇒REF function

7. Dynamic Range and Sweep Rate

1 Press [SHIFT] and [PRESET] keys to reset to initial setting.

2 Connect the N-BNC adapter to the INPUT connector on the front panel.

3 Connect CAL OUT and INPUT connectors on the front panel with the BNC cable (MC-61).

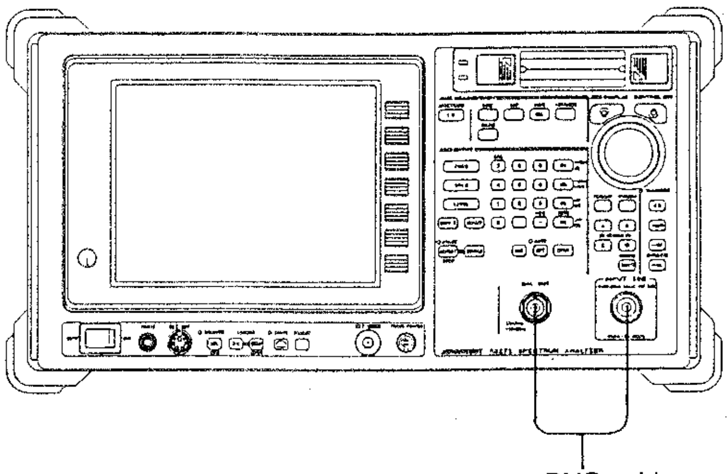


Figure 3-19 Dynamic range and sweep rate

4 Press [LEVEL], [- (B S)], [1], [0] and [GHz (+dBm / sec)] keys to set reference level to -10 dBm.

5 Press [FREQ], [3], [0] and [MHz] keys to set center frequency to 30 MHz.

6 **Press [SPAN], [5], [0] and [MHz] keys to set frequency span to 50 MHz.**

7 **Press [BW], [RBW AUTO MNL], [1], [0], [0] and [MHz] keys to set RBW to 100 kHz.**

Then display noise level decreases by 10 dB, expanding the display dynamic range.

8 **Press [VBW AUTO MNL], [1], [0] and [kHz] keys to set VBW to 10 kHz.**

Setting VBW to approximately 1/10 of RBW averages noise level and obtains wider dynamic range.
Here, setting to "auto" automatically sets sweep rate . If sweep time is forcibly set to, for example, 50 ms, measurement cannot be made correctly due to the error of displayed waveform.
To obtain a high sweep rate, it is necessary to set as follows:

- Make RBW wider.
- Make VBW wider.
- Make frequency span narrower when RBW/VBW does not change.

CHAPTER 4

Basic Operation

This chapter explains basic operation, such as power-on and initialization.

CONTENTS

1. When the Power is Turned ON 4-2
2. When a High Level Signal Exists outside the Bandwidth 4-3
3. Local Feedthrough 4-5
4. Initialization 4-6

1. When the Power is Turned ON

■ Reference frequency

Table 4.1 shows the accuracy for the built-in reference crystal oscillator. This instrument starts warming up the built-in reference crystal oscillator when the power is turned ON.

Table 4-1 Warm-up time for built-in reference crystal oscillator

Starting characteristic (10 minutes after powering up)	5×10^{-8} or less
Aging rate (after 24 hours operation)	2×10^{-8}/day or less

■ Setting

Turning the power ON invokes the setting which was effective when the power was last turned OFF.

Pressing SHIFT and PRESET keys initializes the panel setting.

2. When a High Level Signal Exists outside the Displayed Span

For proper level of measured signal, mixer input level must be -10 dBm or less. Exceeding this level causes input mixer to saturate or distort, leading to inaccurate measurement such as dropping of display level or increased spurious. Therefore, it is necessary to attenuate the signal to measure down to a proper level.
For base band (0 to 3.1 GHz), all signals in the band are added to the mixer. Therefore, depending on the signals to measure, saturation or distortion may occur due to high level signals out of display screen. To avoid this, 2 methods are available:

① Before starting measurement, check the maximum level of the signal, with span set to "Full Span".
② With the setting of input ATT incremented by 10 dB, check that signal levels in the display level do not change.

In 3.0 to 26.5 GHz range, signals are added to the mixer via preselector and therefore the signals out of the measuring frequency range are suppressed by approximately 70 dB, relieving the distortion due to the signals out of the bandwidth.

For example, when 2nd-order harmonic of 1.5 GHz or higher frequency is measured, the fundamental harmonic is suppressed to obtain wider dynamic range.

Following is a sample setting for method ②:

1 **Press** [FORMAT], [Trace], [Trace B] **and** [Store B] **keys to save the current waveform in trace B.**

2 **Press** [MARKER ON], [more 1/3], [more 2/3], [Trace MKR Move] **and** [SRCH] **keys to move the marker on the peak of the waveform.**

3 **Press** [more 3/3] **and** [Delta MKR] **keys to set to Delta Marker mode.**

4 **Press** [more 1/3], [more 2/3] **and** [Trace MKR Move]

keys to move the active marker on trace A.

5 **Press** [ATT] **and** [ATT Auto AUTO MNL] **keys to select MNL, and increment the setting of ATT by 10 dB with the step key.**

At that time, check that the reference level does not change.

6 **Press** MARKER [ON], [Peak] **and** [Next Peak]

keys to adjust the maker at the peak of the waveform, and read the level change.

Compare the currently displayed waveform with that saved in trace B. When the level drop is approximately 1 dB or less, it is concluded that measurement can be made without distortion or saturation.

3. Local Feedthrough

With a superheterodyne type spectrum analyzer, spectrum is measured even when no signal is input, because at the frequency corresponding to 0 Hz, 1st local frequency coincides with 1st intermediate frequency. This spectrum is called "local feedthrough". It can be used to check accurate 0 Hz position, on the other hand it may narrow the dynamic range around 0 Hz.

4. Initialization

It is possible to reset to the initial setting made at shipment or defined by user. The procedure for this is as follows:

1 **Press SHIFT and PRESET key to reset to the initial setting.**

CHAPTER 5

Sample Measurement

This chapter explains how to operate the instrument, showing several sample measurements.

CONTENTS

1. Measurement of Frequency 5-2
2. Measuring the modulation frequency and modulation index of AM signal 5-5
3. Measurement of FM Wave 5-13
4. Measurement of Pulse Modulated Wave .. 5-24
5. Spectrum Analysis of Burst Signal 5-26

1. Measurement of Frequency

■ Sample measurement of approximately 200 MHz signal source

● Frequency measurement with normal marker

Display the input signal so that it can easily be monitored, and move the marker at the peak point.

1 **Press** FREQ, 2, 0, 0 **and** MHz **keys to set center frequency to 200 MHz.**

2 **Press** SPAN, 1, 0, 0 **and** MHz **keys to set frequency span to 100 MHz.**

3 **Press** SRCH **key.**

The frequency at the marker point is displayed at upper right on the screen.

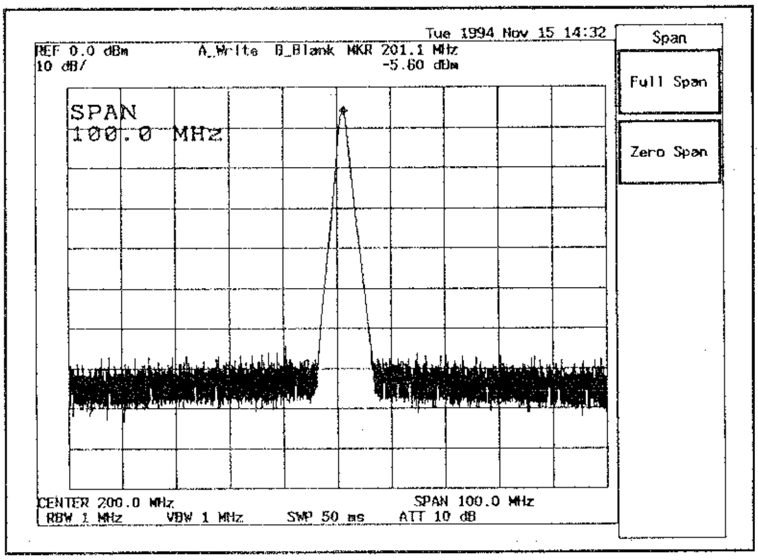


Figure 5-1 Frequency measurement with normal marker

REFERENCE

Measuring accuracy = *±(Reading of marker frequency x Frequency reference accuracy + Span x Span accuracy + 0.15 x Resolution bandwidth + 10 Hz)*

● **Frequency measurement in frequency counter mode**

Select frequency counter mode, and set counter measurement resolution.

CAUTION !

1. ***In the following cases, frequency counter mode may not display correct value.***
   - ***When span > 1 GHz***
   - ***When the difference in noise level from marker point value is 25 dB or less***
2. ***Frequency counter mode cannot be used with SIGNAL TACK mode.***

1 **Press** [CW] , [Counter] **and** [Resolution 10 Hz] **keys to set measuring frequency resolution to10 Hz.**

2 **Set** [Counter ON OFF] **key to ON to enter frequency counter mode.**

The frequency at marker point is displayed at upper right on the screen with 10 Hz resolution.
In this mode, frequency of input signal can be measured even when the marker is not on the peak point.

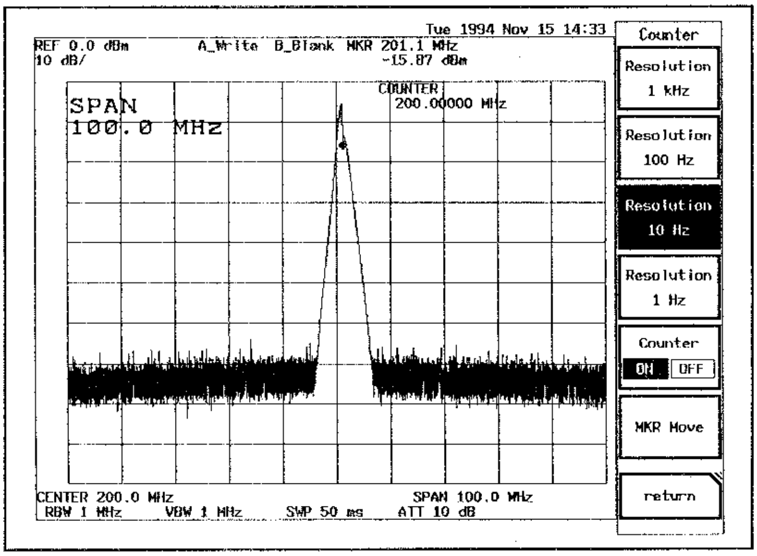


Figure 5-2 Frequency measurement in frequency counter mode

REFERENCE

Measuring accuracy = ±(Read value of marker frequency x Frequency reference accuracy + 5 Hz x N + 1 LSD)
LSD : Least Significant Digit

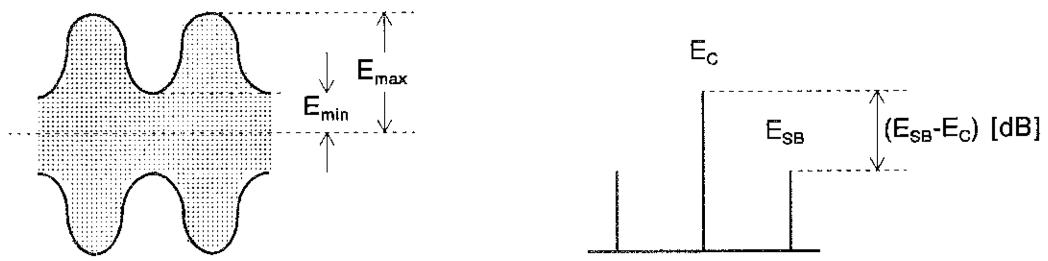
Frequency band	N: order of mixer	Frequency band	N: order of mixer
9 kHz to 3.1 GHz 3.0 GHz to 7.5 GHz 7.4 GHz to 15.4 GHz	N = 1 N = 1 N = 2	15.2 GHz to 23.3 GHz 23.0 GHz to 26.5 GHz	N = 3 N = 4

2. Measuring the modulation frequency and modulation index of AM signal

Compared with time-domain oscilloscopes, a spectrum analyzer shows excellent performance in measuring signal of low modulation degree, such as residual AM and residual FM.
Time-domain measurement calculates the modulation index of AM wave using the following formula (see Figure 5-3 (a)).

m = {(Emax - Emin)/(Emax + Emin)} x 100

With the spectrum analyzer, we can read the level difference of the sidebands to the carrier in dB (see Figure 5-3 (b)).
In addition, the modulation degree of the modulated signal with respect to higher harmonics can be obtained individually. Especially when modulation degree is low, time-domain measurement is in units of 2%, while spectrum analyzer can measure down to less than 0.02%.
The measuring accuracy becomes higher in LINEAR mode when modulation degree is equal to or higher than 10%, while higher in LOG mode when modulation degree is lower than 10%.



$$m(\%) = \frac{E_{max} - E_{min}}{E_{max} + E_{min}} \times 100$$

$$m(\%) = \log^{-1} \frac{E_{SB} - E_C + 6}{20}$$

(a) AM signal measured on time domain (linear scale)

(b) AM signal measured on frequency domain (log scale)

Figure 5-3 Measurement of AM signal

■ Sample measurement of AM wave of low modulation degree and high modulation index

Measurement is made on time domain with linear scale.

1 **Display the signal to measure, and adjust the peak to reference level.**

In this example, carrier is set to 903 MHz.

Press [FREQ], [9], [0], [3] and [MHz] keys and then [SPAN], [2], [0] and [MHz] keys.

Press [LEVEL] key, and turn the data knob so that the peak of signal level is equal to the reference level line.

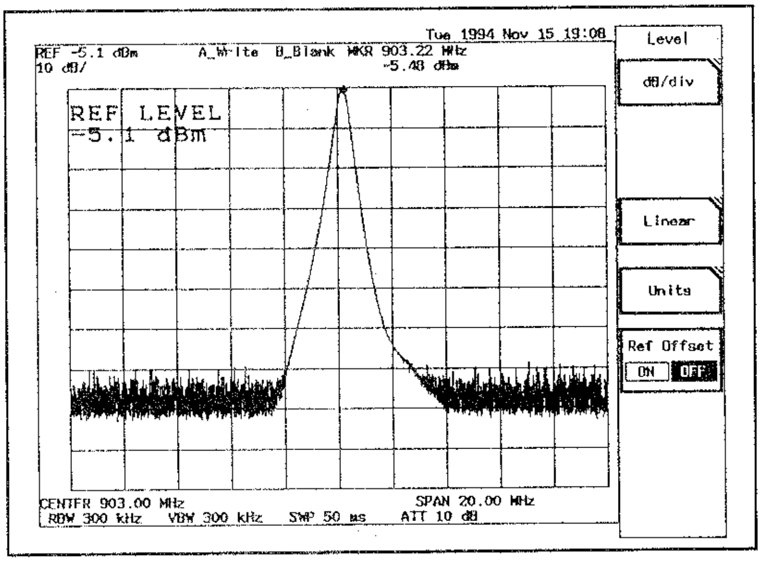


Figure 5-4 Adjusting the signal level

2 **Press** [BW] **and** RBW [AUTO] [MNL] **keys to select MNL, and set resolution bandwidth to 3 times or more of modulation frequency.**

3 **Press** [LEVEL] **and** [Linear] **keys to set the vertical scale to "Linear".**

4 **Press** [SPAN] **and** [Zero Span] **keys to set to Zero Span mode.**

5 **Press** FORMAT [ ] **,** [Trace Detector] **and** [Sample] **keys to set trace detector to "Sample".**

6 **Press** [LEVEL] **key, and turn the data knob so that the peak of signal level is equal to the reference level line.**

7 **Press** [SWEEP] **,** [Trigger Source] **and** [Video] **keys to set trigger mode to Video.**

8 **Press** [SWP T] **and** [Swp Time AUTO MNL] **keys to select MNL, and operate the step key to set sweep time to a value which makes it easy to monitor waveform.**

Press [Single] **to stop the sweeping temporally.**

9 **Press** MARKER [ON] **and** [Peak] **keys to move the marker on the peak of waveform.**

10 **Press** [more 1/2], [return], [Delta MKR], [Peak] **and** [Next Peak] **keys.**

The period of modulated wave T(s).

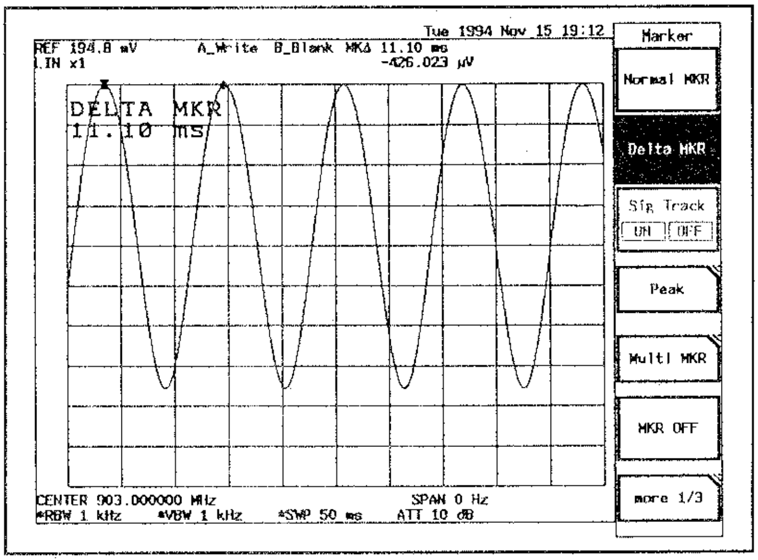


Figure 5-5 Measuring the period of modulated wave

11 **Press** [more 1/2], [return], [more 1/3] **key and set** [1/Delta MKR ON OFF] **key to ON to obtain modulation frequency.**

12 **Press** MARKER [ON] **and** [Normal MKR] **keys to move the marker to the maximum point of waveform, and record the level (Emax value).**

13 **With data knob, move the marker to the minimum point of waveform, and record the level (Emin value).**

Assign these values to the following formula to calculate modulation index m.

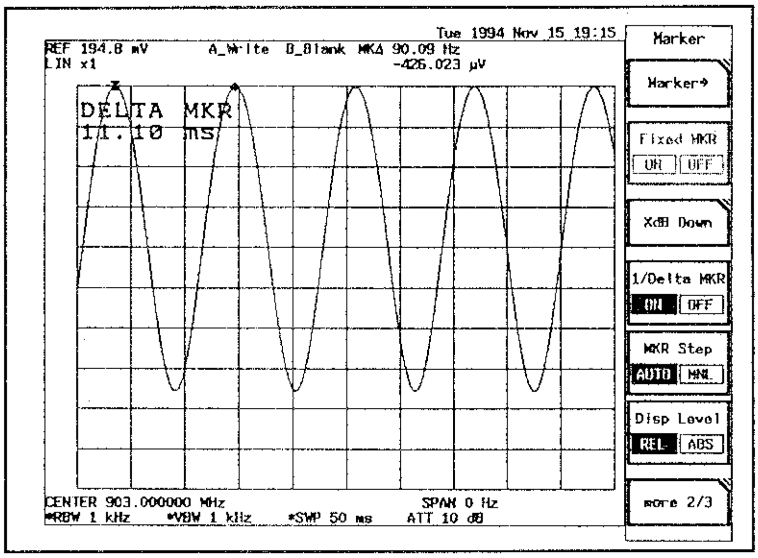


Figure 5-6 Modulation frequency of AM wave

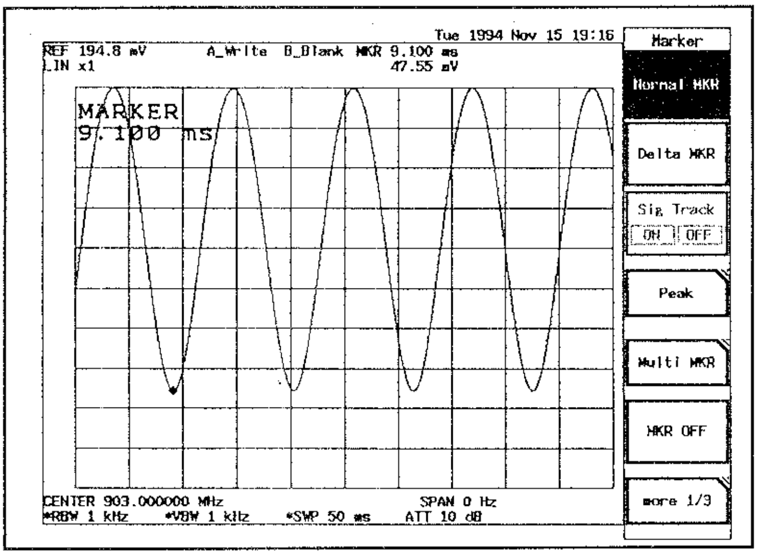


Figure 5-7 Modulation index of AM wave

■ Sample measurement of AM wave of high modulation frequency and low modulation index

Measurement is made on frequency domain of log scale.

1 **Press [SPAN] key, and operate the step key to set frequency span to a value which is greater than twice the modulation frequency but smaller than 10 times.**

2 **Press [FREQ] key, and turn the data knob to set center frequency to the carrier frequency.**

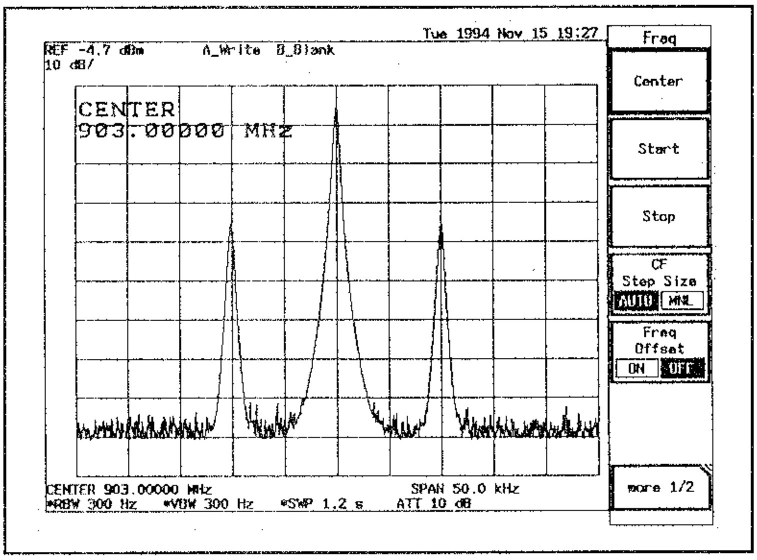


Figure 5-8 Setting of center frequency

3 **Press MARKER [ON] and [Peak] keys to move the marker to the peak of the carrier.**

4

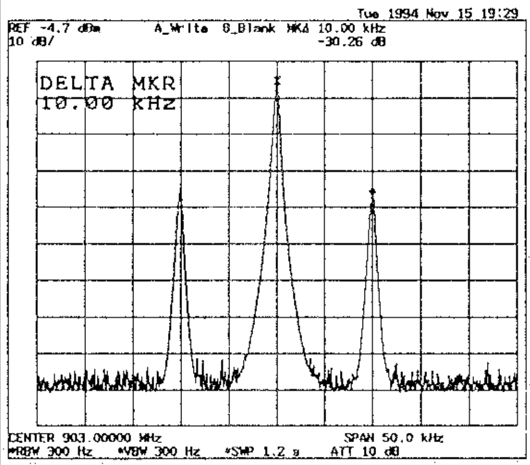
Press [more 1/2], [return] **and** [Delta MKR] **keys, and turn the data knob to move the delta marker to the peak of the spectrum of modulated signal.**

From the frequency at delta marker point and displayed level value, modulation frequency fm and modulation index m are calculated using the following formulae.

fm = Frequency at delta marker

$$m = \log^{-1} \frac{E_{SB} - E_C + 6}{20}$$

Figure 5.10 shows the relation between E_{SB} - E_C [dB] and m [%].



fm = 10.0 kHz

E_{SB} - E_C = 30.26dB

Figure 5-9 AM wave of high modulation frequency and low modulation index

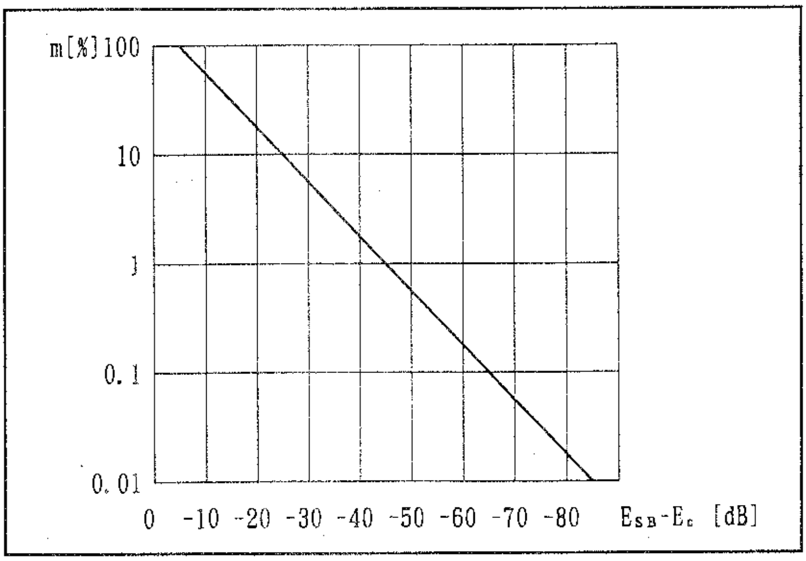


Figure 5-10 Relation between sideband level-carrier level (E_{SB} - E_C) and modulation index m(%)

3. Measurement of FM Wave

For FM wave, in general, carrier frequency fc, modulated wave frequency Fm, frequency deviation Δf_{peak}, modulation index m, occupied bandwidth etc. are measured.

Modulation index m of FM wave can be expressed by $\Delta f_{peak}/fm$. The relation which makes the carrier lowest when modulation index is 2.4, 5.6, 8.6, ... is obtained to calculate modulation index m or frequency deviation Δf_{peak} (see Figure 5-11 (a) and (b)).

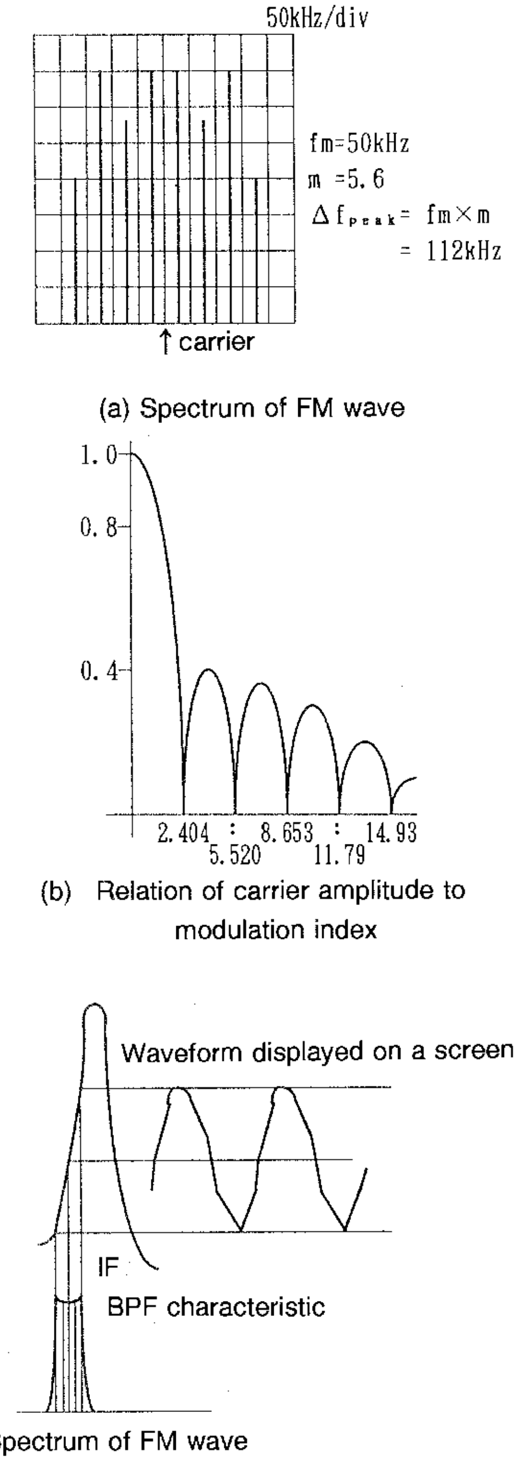
It is often the case with FM wave that we cannot understand the content of modulation only with the spectrum but can understand when FM component of input signal is converted into and displayed by the change of amplitude.

In this case, discriminator is used additionally. But spectrum analyzer can detect utilizing the slope of IF and B.P.F. The modulated wave thus detected is displayed on the screen (see Figure 5-11 (c)).

When modulation frequency is low, set the horizontal axis to Zero Span to operate as a fixed modulation receiver. Measurement is made in time domain.

When modulation frequency is high, measurement is made in frequency domain, and modulation frequency is obtained from sideband frequency.

When modulation index m is small (approximately 0.8 or less), m is obtained from the relation between carrier level and 1st sideband level.



(a) Spectrum of FM wave

(b) Relation of carrier amplitude to modulation index

Spectrum of FM wave

(c) Direct viewing of FM wave

Figure 5-11 Measurement of FM wave

Sample measurement of FM wave of low modulation frequency

1 Press FREQ key, and operate the step key or data knob to adjust the carrier at center frequency.

2 Press BW and RBW AUTO MNL keys to select MNL, and operate the step key to set resolution bandwidth to 3 times or more of modulation frequency.

3 Press LEVEL key, and turn the data knob so that the peak of signal level is equal to the reference level line.

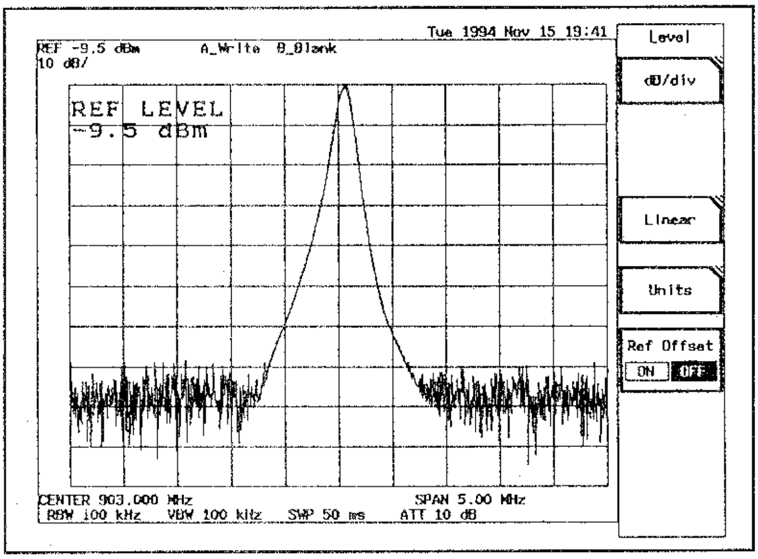


Figure 5-12 Adjustment of signal level

4 Press SPAN and Zero Span keys to enter Zero Span mode.

5 **Press** FREQ **key, and operate the step key or data knob to change the center frequency so that the modulated waveform is displayed at the center on the screen.**

6 **Press** SWEEP , Trigger Source **and** Video **keys to set trigger mode to Video.**

7 **Press** SWP T **and** SWP Time AUTO MNL **keys to select MNL, and operate the step key to adjust sweep time so that modulated wave can easily be seen on the screen.**

8 **Press** MARKER ON **and** Peak **keys.**

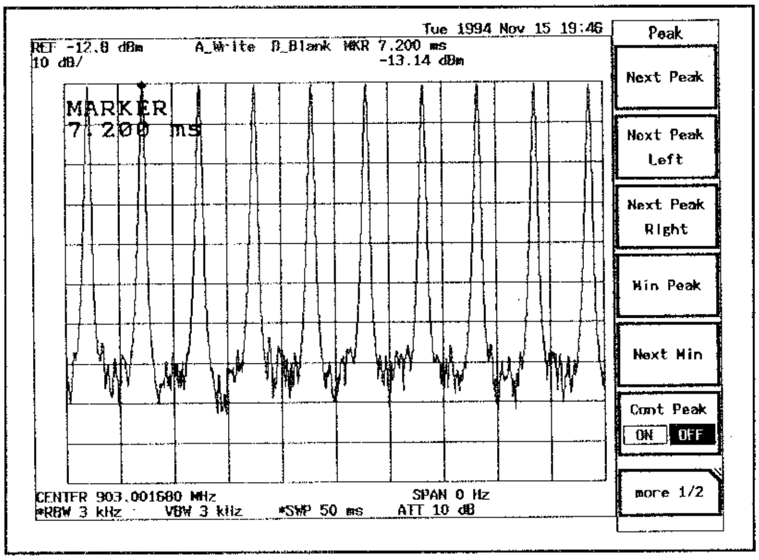


Figure 5-13 Moving the marker to the peak of modulated wave

9 **Press** [more 1/2], [return] **and** [Delta MKR] **keys to move the delta marker to the adjacent peak with the data knob.**

10 **Press** [more 1/3] **and set** [1/Delta MKR AUTO MNL] **to ON to calculate modulation frequency fm.**

$$fm = \frac{1}{T(s)}$$

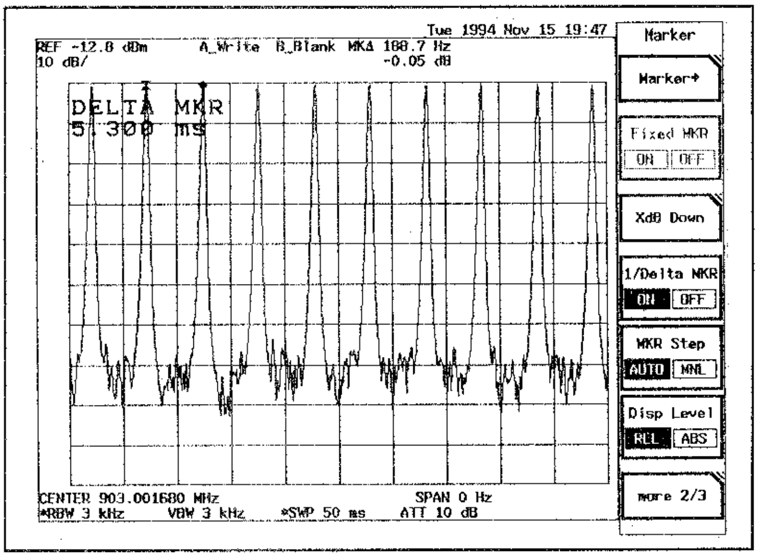


Figure 5-14 FM wave of low modulation frequency

■ Sample measurement of FM wave of high modulation frequency and low m value

1 Press [SPAN] key, and operate the step key to set frequency span to a value greater than twice the modulation frequency but smaller than 10 times that.

2 Press [FREQ] key and turn the data knob to adjust carrier frequency at center frequency.

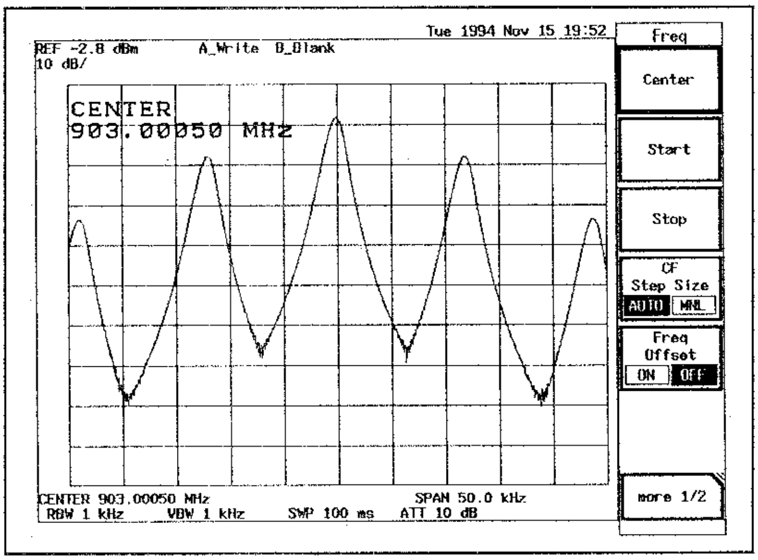


Figure 5-15 Adjusting carrier frequency at center frequency

3 Press MARKER [ON] and [Peak] keys to move the marker on the peak of carrier.

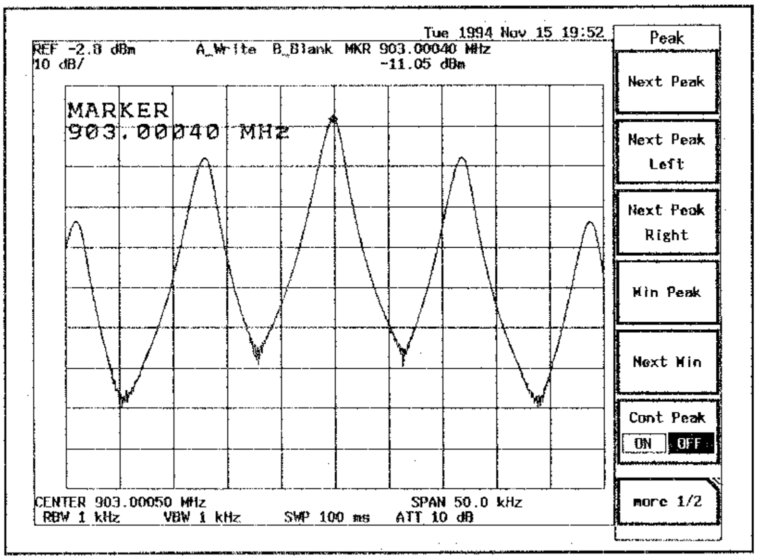


Figure 5-16 Carrier peaks

4 **Press [more 1/2], [return] and [Delta MKR] keys and turn the data knob to move the delta marker to the peak of adjacent sideband signal.**

The displayed frequency value for the marker position becomes the modulation frequency fm.

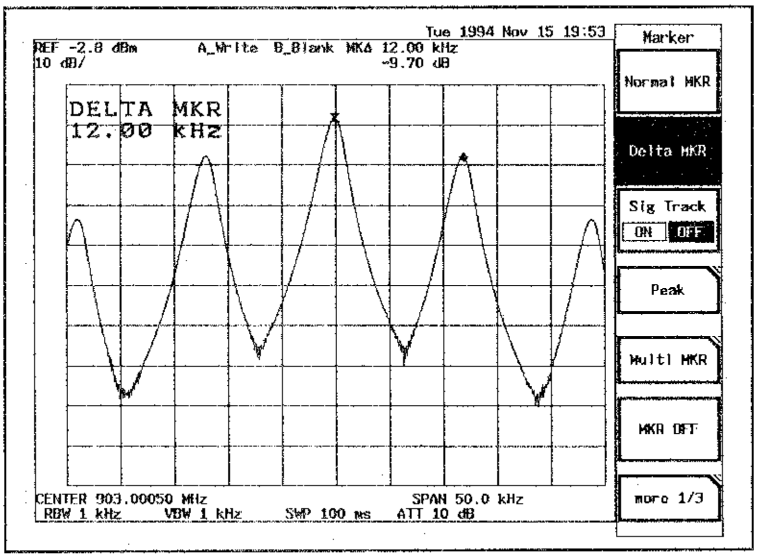


Figure 5-17 FM wave of high modulation frequency and low m value

■ Sample measurement of the deviation of FM wave peak (Δf peak)

1 **Press BW and RBW [AUTO] [MNL] keys to select MNL, and operate the step key to set resolution bandwidth to a value which includes main sidebands (5 times the modulation frequency or more).**

2 **Press FREQ key and turn the data knob to adjust center frequency at the carrier frequency.**

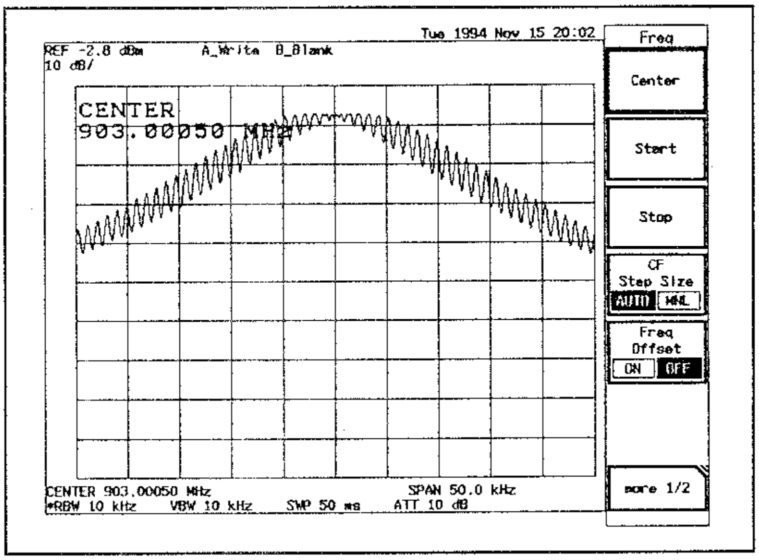


Figure 5-18 Adjusting center frequency at the carrier frequency

3 **Press SPAN key and operate the step key to set frequency span to a value which makes it easy to monitor waveform, according to peak deviation.**

4 **From the waveform, measure $\Delta f_{peak\ peak}$.**

Δf_{peak} and modulation index m are calculated using the following formulae.

$$\Delta f_{peak} = \frac{1}{2} \Delta f_{peak\ peak}$$

$$m = \frac{\Delta f_{peak}}{fm}$$

- When Δf_{peak} is small

$\Delta f_{peak\ peak}$ = Frequency at delta marker

= 5.30 kHz

$$\Delta f_{peak} = \frac{1}{2} \Delta f_{peak\ peak}$$

= 2.65 kHz

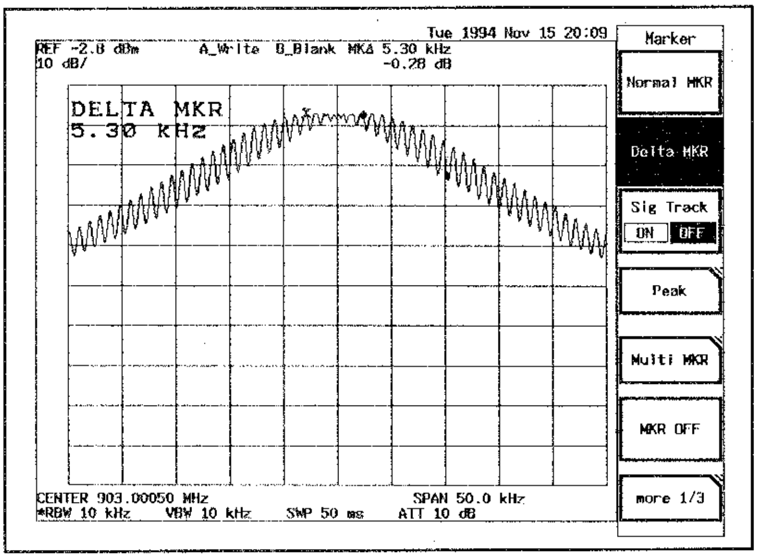


Figure 5-19 FM wave with small Δf_{peak}

- When Δf_{peak} is large

$$\Delta f_{peak\ peak} = \text{Frequency at delta marker}$$

$$= 295\ \text{kHz}$$

$$\Delta f_{peak} = \frac{1}{2}\ \Delta f_{peak\ peak}$$

$$= 147.5\ \text{kHz}$$

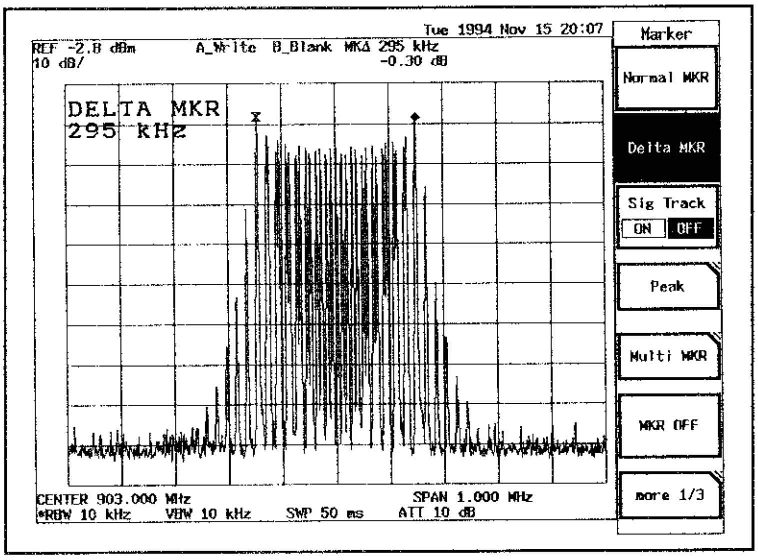


Figure 5-20 FM wave with large Δf_{peak}

How to obtain m when FM modulation index m is small

For FM wave with 0.8 or smaller modulation index m, the following formula can be used.

$$m = \frac{2E_{SB}}{E_C}$$

E_{SB} : Level of 1st sideband

E_C : Level of carrier

On the screen of log scale,

$$M = \log^{-1} \frac{E_{SB} - E_C + 6}{20}$$

$E_{SB} - E_C$: Difference in level between 1st sideband and carrier [dB]

1 **Properly set center frequency and frequency span so that carrier can easily be monitored, and adjust carrier level to the reference level.**

Press [FREQ] key and adjust center frequency with the data knob.

Press [SPAN] key and adjust frequency span with the step key.

Press [LEVEL] key and adjust carrier level with the data knob.

2 **From the center frequency displayed, read carrier frequency fc. Then, read carrier level Ec [dBm] (see Figure 5-21).**

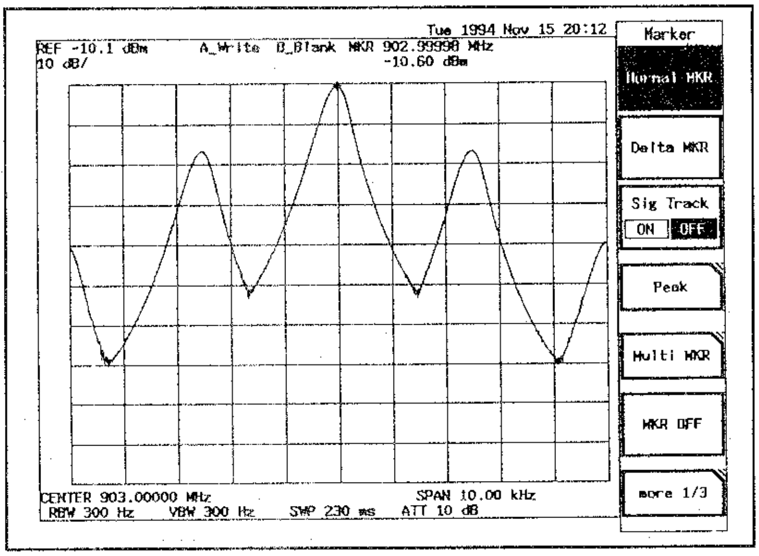


Figure 5-21 f_C and E_C of FM wave

3 **Press MARKER [ON] and [Peak] keys.**

4 **Press [more 1/2], [return] and [Delta MKR] keys, and turn the data knob to move the delta marker on the 1st sideband wave, and read f_{SB} and E_{SB} [dBm] values from the displayed values for delta marker position (see Figure 5-22).**

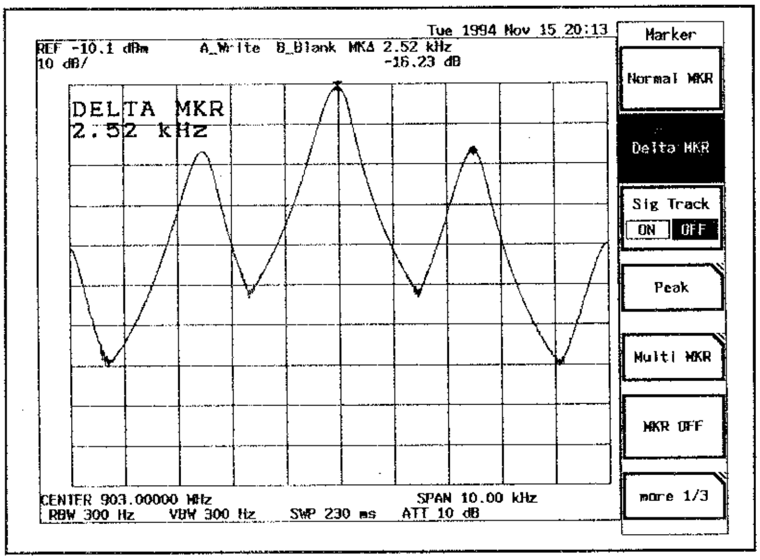


Figure 5-22 f_{SB} and E_{SB} of FM wave

5 **Calculate FM modulation index m using the following formula.**

$$m = \log^{-1} \frac{E_{SB} - E_C + 6}{20}$$

6 **Obtain modulation frequency fm using the following formula or from the displayed frequency value for the delta marker position.**

$$f_m = |f_{SB} - f_C|$$

7 **Calculate frequency deviation Δf_{peak} using the following formula.**

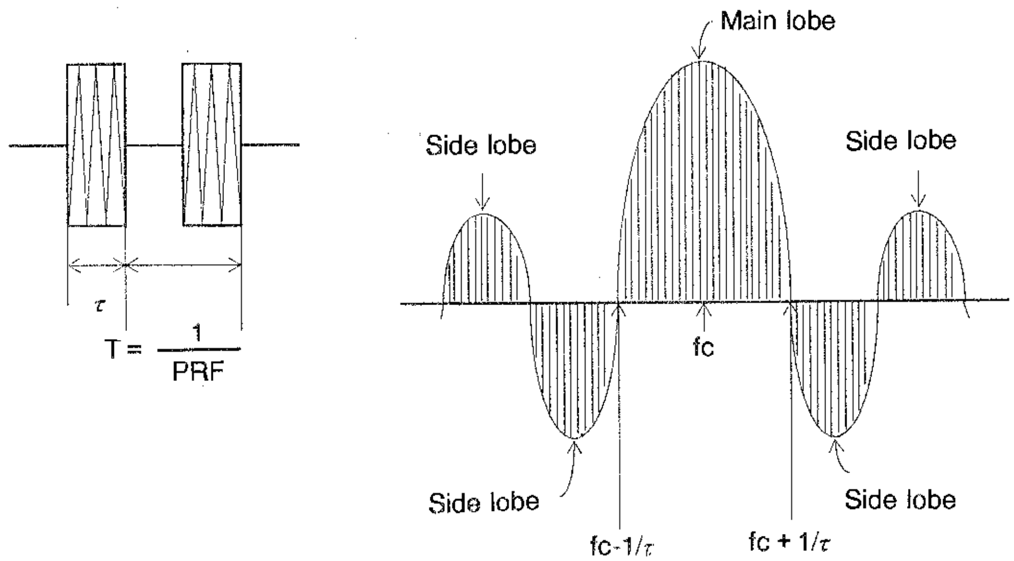
$$\Delta f_{peak} = m \times f_m$$

4. Measurement of Pulse Modulated Wave

The spectrum analyzer equivalently decomposes a wave to display higher harmonics and fundamental wave which are included in the signal. When a pulse modulated waveform displayed in time domain, as shown in Figure 5-23 (a), is converted to frequency domain, the spectrum which has an envelope with carrier frequency Fc at its center can be obtained, as shown in Figure 5-23 (b).

When a pulse modulated signal, such as a radar signal, is measured with the spectrum analyzer, the following items can easily be obtained.

- Pulse repetition frequency (PRF)
- Pulse width (τ)
- Carrier frequency (fc)
- Peak power (P_{peak})
- Mean power (P_{ave})



(a) Time based display

(b) Frequency based display

Figure 5-23 Pulse modulated wave

CAUTION !

1. ***The maximum input level of this instrument is +30 dBm, 0 VDC when the input attenuator is set to 10 dB or more. Because pulse modulated wave such as radar wave tends to have a high peak power, be sure to sufficiently attenuate the signal with coupler or the like before inputting to the INPUT connector of this instrument.***
2. ***Because the input level of the mixer of this intrument is -10 dBm, set the input attenuator so that P_{peak} does not become greater than -10 dBm. To avoid the mixer from saturating, set the input attenuator to the lowest value which does not cause signal level to decrease, by lowering the input attenuator value in units of 10 dB from 50 dB.***

■ Pulse width (τ)

Pulse width (τ) is the inverse number of 1/2 the main lobe width or of side lobe width. To obtain an envelope with sufficient resolution, it is necessary to set resolution bandwidth within the following range.

Pulse repetition frequency (PRF) × 1.7 ≦ Resolution bandwidth ≦ 0.1/τ

■ Carrier frequency (fc)

Measuring accuracy of carrier frequency (fc) depends on pulse width (τ). When τ is small, main lobe becomes wide, making it difficult to find the center. To make the center clear, it is necessary to set SPAN/DIV to a wider value than $1/\tau$. Here, the accuracy of measured frequency is the accuracy of center frequency under set SPAN/DIV value.

■ Peak power (P_{peak})

When resolution bandwidth of the spectrum analyzer satisfies the following conditions, displayed amplitude is proportional to resolution bandwidth.

Pulse repetition frequency (PRF) × 1.7 ≦ Resolution bandwidth ≦ 0.2/τ

Here, displayed amplitude value is proportional to resolution bandwidth, and the relation between actual peak power P_{peak} (dBm) and displayed amplitude value P'_{peak} (dBm) is as follows.

$P_{peak} = P'_{peak} - \alpha$ (dB)
α (dB) $= 20 \log (\tau \times 1.5 \times \mathrm{RBW})$ α : Pulse attenuation factor

■ Mean power P_{ave} (dBm)

Mean power P_{ave} (dBm) is calculated using the following formula.

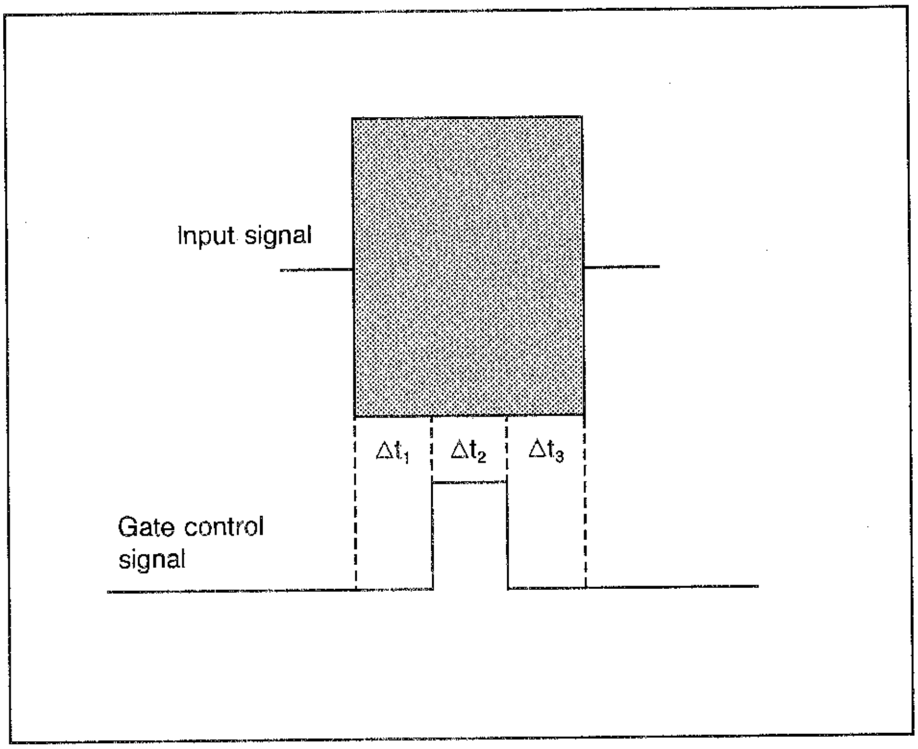
$P_{ave} = P_{peak} \times \mathrm{PRF} \times \tau$ PRF : Pulse repetition frequency (Hz)
τ : Pulse width (s)

5. Spectrum Analysis of Burst Signal

Gated sweep function enables spectrum analysis of burst signal.

■ Measuring method

Execute gate control with the gated sweep control (GATE IN) terminal on the rear of the instrument.
Sweep is started at "Hi" TTL level (or open) and stops at "Lo".
Input signal and gate control signal must conform to the following specifications.



	RBW				
	5MHz to 1MHz	300kHz	100kHz	30kHz	10kHz
Δt_1	2μs or more	15μs or more	20μs or more	50μs or more	180μs or more
Δt_2	1μs or more				
Δt_3	15μs or more				

NOTE
To measure noise, select SAMPLE for detection mode.

CHAPTER 6

RECORD AND OUTPUT

The record and output of the measurement data and the setting are described in this chapter.

CONTENTS

1. Record to the Memory Card 6-2
2. How to Output to the Printer 6-12
3. Output for Plotter 6-17
4. Output to the File 6-21
5. Setup for the Target Device of the Screen Data Output 6-24

1. Record to the Memory Card

The memory card is used in this instrument as the media in which the current set condition and the waveform data are stored. The features of the functions of the memory card are as follows:

- The memory card adapted to the PC card guide line Ver 4.0 of the Japan Electronic Industry Development Association (JEIDA) or to PCMCIA Release 2.0 of the United States of America standards.
- There are two slot memory card drives and the two memory cards can be used simultaneously.

Usable Memory Card

- Adapted to JEIDA Ver.4.0 or higher (68 pin two piece connector).
  TYPE1
- Only the following Memory types are permitted.
  Common memory : SRAM
  Attribute memory : Any one of the SRAM, EPROM, MASKROM, EEPROM, OTPROM or flash memory is all right.
- Formatting
  MS-DOS format.
  Corresponding to the various kinds of memory size.

CAUTION !
Only the memory cards that are adapted to the PC card guide line Ver 4.0 of the Japan Electronic Industry Development Association (JEIDA) or to PCMCIA Release 2.0 or higher of the United States of America standards are permitted. Use the memory cards only after making sure that those are adapted to the standards as above. See the page A-18 for further information.

Memory Card Specifications

Table 6-1 Memory Card Specifications

Specifications	Memory Card
Connector	68 Pin two Piece Connector
Interface	In accordance with JEIDA Ver.4.0
Dimensions	54 (Width) × 86 (Length) × 3.3 (Thickness) mm
Operating Environment	No condensation Operating environment: 0 to 55°C Storage environment: -20 to 60°C Relative humidity: Less than 95%
Write protect	Switching ON and OFF by the switch. It is impossible to write it set to ON.

Contents of Storage to Memory Card

The followings are the contents that are able to be stored in the memory card.

- **Set condition of the display screen**

- **The trace data and the table data**

They are stored when each functions are set to ON and when they are selected by [Select Item].

- Trace data A,B
- Connection factor
- Limit line 1
- Limit line 2

Note on Handling the Memory Card

- Keep dust out from the hole of the connector.
  It causes defective contact or damage of the connector.
- Do not touch the connector with a material like a metal needle and so on.
  It may cause the static electricity destruction.
- Do not bend it or give a shock on it.
- Keep it away from water.

Insertion and Ejection of Memory Card

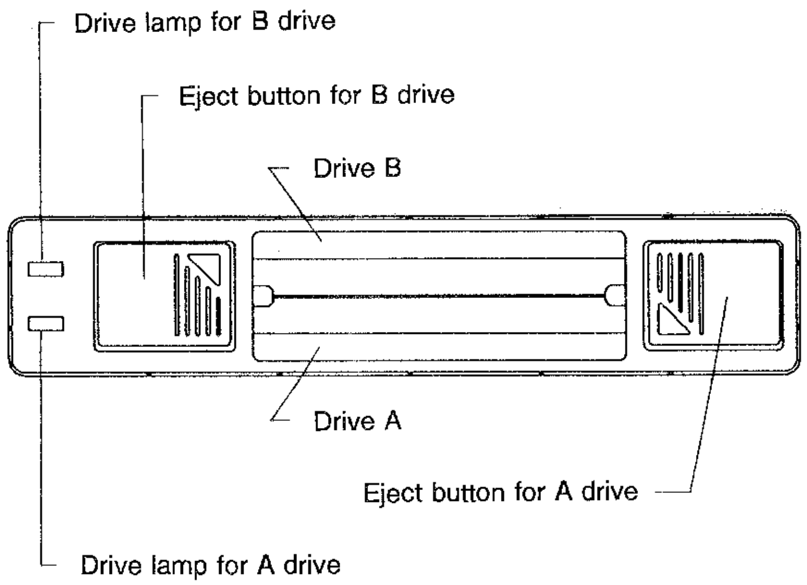


Figure 6-1 Drive Slot for Memory Card

The drive slots for the memory card are on the right upper side of the front panel.

1. **Insert the memory card with the printed side up.**

   The drive lamp is turned on with yellow color when the memory card is inserted.

2. **When the memory card is ejected, press the eject button only after making sure that the drive lamp is turned on with yellow color.**

   CAUTION !
   The drive lamp is turned on with red color when the card is given access. Do not press the eject button to eject the memory card when the drive lamp is red.
   In the case that the memory card is ejected when the drive lamp is red, the data in the memory card is not guaranteed.

How to Initialize the Memory Card

Use the memory card that is not yet used only after initializing it.

1 **Turn the write protect of the memory card to the side of OFF.**

WARNING !
Every data will be erased when the memory card that have the stored data is initialized again.

2 **Insert the memory card.**

3 **Press** SHIFT [●], SAVE [RCL] **and** [Setup MEM Card] **to display the software menu for selecting the card to be initialized.**

4 **Press** [Format Card A] **or** [Format Card B] **key to specify the initializing of the card that is inserted into each drive.**

When the dialog box is appeared on pressing each key, select "Confirm" by turning the data knob and press data knob to execute the initialization.

Confirmation
Format Memory Card-A?
[Confirm] [Cancel]

In the case of not executing the initialization, select "Cancel" and press the data knob.

CAUTION !
The key operation on the panel is prohibited on executing the initialization.
The time that the initialization needs is different according to the capacity of the memory card, but at the end of the initialization the indication of "Confirmation" is disappeared. Furthermore, the memory card should not be ejected in executing the initialization.

■ How to Store into the Memory Card (Save Function)

CAUTION !

1. ***In the case that the data in the trace A or B is to be stored, set the trace mode in VIEW before execution. The waveform data cannot be stored in WRITE or BLANK mode.***
2. ***In the case that the prepared table data is to be stored, execute after setting the function in which that data is used in ON.***
   "Select Item" is "Default" in both case of 1 and 2. Furthermore, each item can be selected optionally by "Select Item".

1 **Press** SHIFT [●], SAVE [RCL], **and** Device [RAM] [A] [B] **and specify the drive of the memory card.**

The drive A is on the lower side and the drive B is on the upper side.

2 **Press** [Save File] **key.**

The screen shown in the Figure 6-2 is displayed.

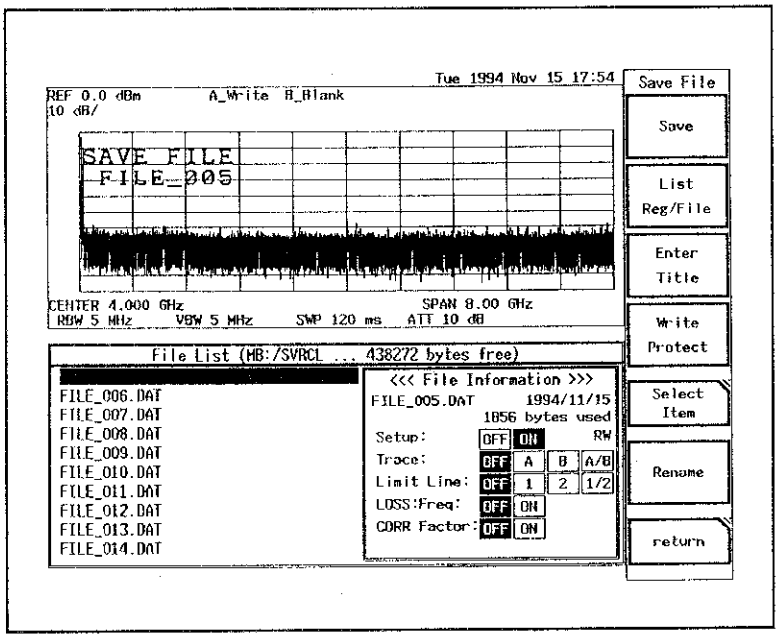


Figure 6-2 The Menu Screen of Save Function

3 **Move the objective file by the step key or by the data knob to the position of the cursor to specify the file.**

In the case of making a new file, move the last line of the file list to the specified cursor.

4 **Press** Save **to store the set condition into the memory card.**

The file name is created automatically just on saving.

■ How to Call from the Memory Card (Recall Function)

1 **Press** [SAVE RCL] **and** [Device RAM / A / B] **to specify the drive of the memory card.**

The drive A is on the lower side and the drive B is on the upper side.

2 **Press** [Recall File] .

The screen shown in the Figure 6-3 is displayed.

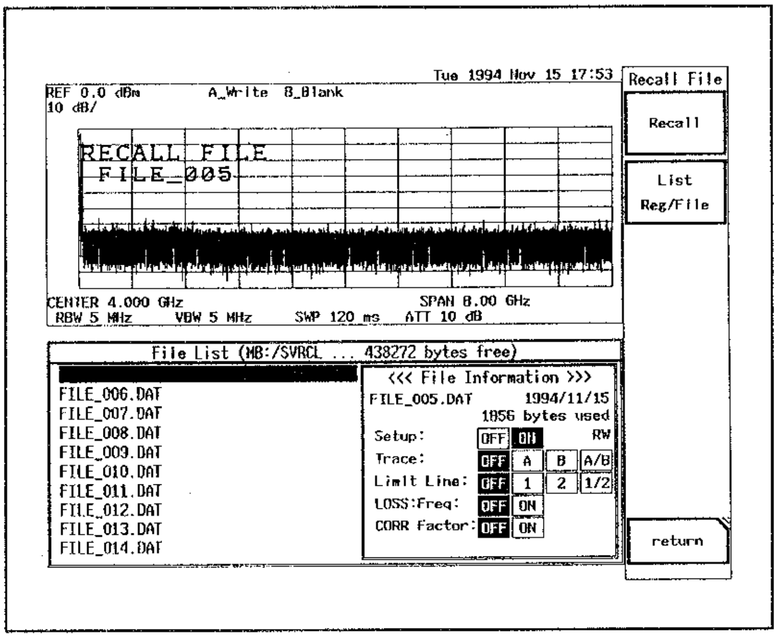


Figure 6-3 The Menu Screen of the Recall Function

3 **Specify the file by the step key or by the data knob.**

4 **Press** [Recall] **to call the set condition of the specified file.**

CAUTION !
In the case of recalling only the data of the trace A or B, set trace in VIEW A or B before executing the recall.

Back Up of the Memory Card

● Life Span of the Back Up Battery

The SRAM card contains a battery. The life span of the battery depends on the static electrical current consumption.

The static electrical current consumption increases as the increase of the memory capacity and the life span of the battery is shortened as a result.

WARNING !

The life span of the battery is shortened when the memory card is left at the place in high temperature. Eject the memory card from this instrument when it is not used.

● How to Back up the Memory Card

It is possible to back up the memory card (all copy) when exchanging the battery by using the two drive slots.

1 **Insert the memory card to be backed up into the drive slot A and the memory card that has the same capacity to be copied all the data into the drive B.**

2 **Press the keys in order of** [SHIFT], [SAVE RCL], [Setup MEM Card] **and** [Copy All].

The following Confirmation message is displayed.

Confirmation
Copy Memory-Card A to B?
[Confirm] [Cancel]

3 **Select "Confirm" by the data knob or the step key and press the data knob to execute the all copy.**

In case of not executing the all copy, press the data knob after selecting "Cancel".

CAUTION !

It is impossible to copy all when the capacity of the memory is different.

● **How to Exchange the Battery**

CAUTION !
When exchanging the battery, all the data that is stored in the memory card is cleared off.
Exchange the battery after copying the necessary data to another memory card.

The method of exchanging the battery of the memory card is different according to the manufacturer or the capacity of the memory card to be used.
Follow the process that is described in the user's manual of the memory card to be used to exchange the battery.

2. How to Output to the Printer

This instrument can output the screen data to the printer that is equipped with the parallel interface based on the centronics standards by using the PARALLEL port on the back panel (Graphic dump).

CAUTION !

1. ***Connect the cable after turning off the switch.***
2. ***Depending on the kind of the printers to be used, there are some that does not begin the initial operation until the instrument is powered on.***
3. ***The data that is output from this instrument is monochrome. It does not output in color even if it is connected with the printer corresponding to the color mode.***
4. ***The resolution of output is 180Dot/inch. The stripes will appears when the printer with its solution is not the integral times of 180Dot/inch is used.***
5. ***Check the control code of the printer to be connected. Then, set the corresponding code (ESC/P or HP PCL) to the analyzer.***

■ Connectable Printer

This instrument adopts ESC/P (Epson Standards Cord for Printer) or HP PCL as the control code for the printer, so the printer corresponding to ESC/P or HP PCL is able to be connected.
The recommended printers that are able to be connected to this instrument is shown in the Table 6-2. Furthermore, the cable that connects the instrument with the printer should be the type designated by each manufacturer.

Table 6-2 Recommended Printer

Name of Manufacturer	Type Name
SEIKO EPSON	Mach Jet Printer series
Hewlett Packard	HP DeskJet505J Plus
Hewlett Packard	HP DeskJet500 series

Specification of the Output Form

The output form that is supported by this computer is monochrome data, but the printing mode is able to be selected from the three types shown in the Table 6-3.

Table 6-3 Printer Output Format

Type	Printing Mode		
Gray	Four gray scale	A4 full size	Landscape printing
Mono S	No gray scale	A4 half size	Portrait printing
Mono L	No gray scale	A4 full size	Landscape printing

1 **Press the keys in order of** SHIFT [●] , CONFIG [COPY] **and**

[Printer] .

The following dialog box is appeared.

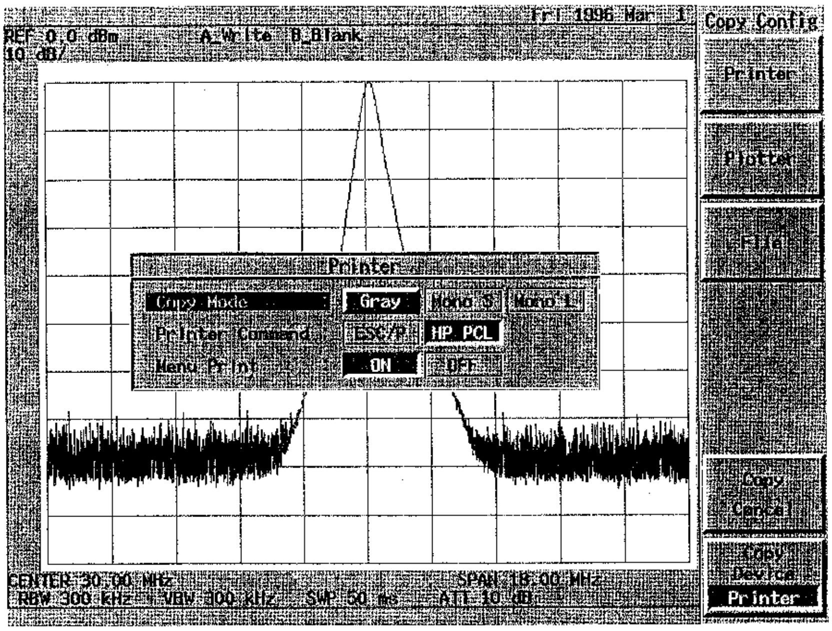
Printer			
Copy Mode :	Gray	Mono S	Mono L
Printer Command :	ESC/P	HP PCL	

2 **Select one of "Gray/Mono S/Mono L" by turning the data knob and press the data knob to specify.**

The printing examples in each printing modes are shown in the Figure 6-4, the Figure 6-5 and the Figure 6-6.

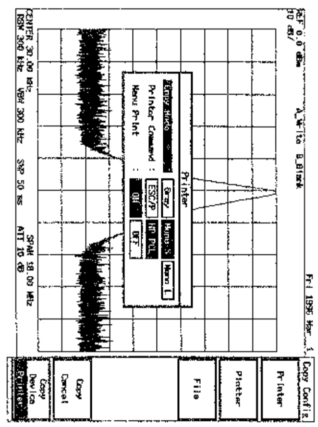
3 **Select ESC/P or HP PCL depending on the control command of the output printer, then press the data knob to set that.**

CAUTION !
If the printer is turned off after the setting is changed but the dialog box is being displayed, the setting is ignored.



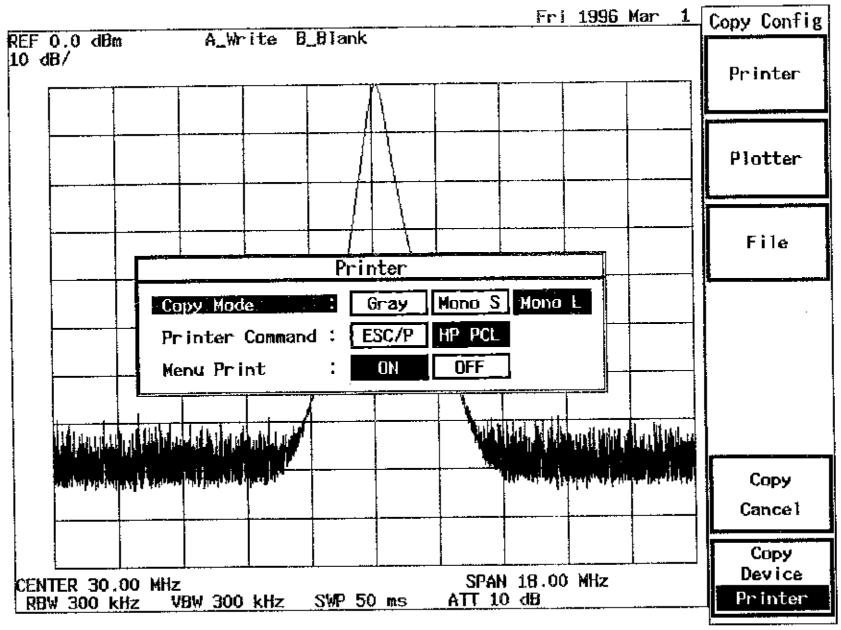
A4Paper Side

Figure 6-4 Printing Example in the Printing Mode "Gray"



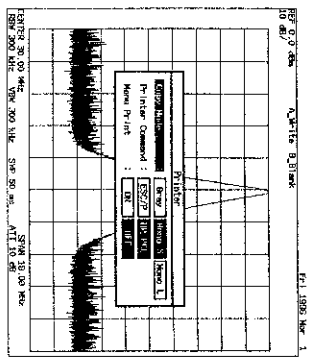
A4Paper Side

Figure 6-5 Printing Example in the Printing Mode "Mono S"



A4Paper Side

Figure 6-6 Printing Example in the Printing Mode "Mono L"



A4Paper Side

Figure 6-7 Printing Example in the Menu Print "OFF"

Output to the Printer

The output to the printer is started on pressing the "COPY" key. The output data is the data that is displayed just when the "COPY" key is pressed. It is possible to operate the panel keys after starting the output. (It does not need to wait the end of printing.) And the output data is not affected by operating the panel keys in printing.

CAUTION !

1. ***It needs about one minute for printing. (It is different according to the printer to be used and the printing mode.)***
2. ***The printing demand is ignored even if the "COPY" key is pressed again in printing.***

3. Output for Plotter

The screen data can be output to a plotter is adapted the HP-GL which is communicated by GP-IB interface of the Spectrum Analyzer.

CAUTION !

1. ***Connect GP-IB cable after AC power turned off.***
2. ***Read the manual of the plotter to be used.***
3. ***Dialog box, list display (Multi-marker list and other), characters only display Measurement parameter set and other) and graphic display (Graphics of the modulation analysis and other) cannot be plotted.***

■ Available plotter

The Spectrum Analyzer becomes available to interface the plotter is adapted the control command set of HP-GL (Hewlett-Packard Graphics language).
However, GP-IB interface is not strictly for the interface standards, therefore, it is necessary to check the actual interface operation.
Listed plotters in the following table checked for the operation by ADVANTEST.

Table 6-4 Operation tested plotters by ADVANTEST

Manufacturers	Model name
ADVANTEST	R9833
Hitachi Denshi	682-XA (Note) Set all of 4 pens to the pen slot.
Hewlett Packard	HP7470A, HP7440A, HP7475A and HP7550A.

■ Setup for the plotter

Setup listen only or 0 to 30 for the plotter address.
Some plotters need more setup in addition to the setup of the address, if it is necessary then read manual for details.
Set A4 size paper in landscape orientation on the platter.

Setup for the plot format

1 **Press the key in order of** SHIFT [●], CONFIG [COPY] **and** [Plotter].

Following dialog box is displayed.

Plotter				
Copy Mode :	ALL	TRACE		
Division :	1	2	4	
Locate Mode :	AUTO	MANUAL		
Location :	UpLeft	UpRight	LowLeft	LowRight
GPIB Mode :	TALK ONLY	ADDRESSABLE		
Plotter Address :				

2 **Rotate data knob, select desired item and set it by pressing the data knob.**

Copy Mode : ALL ; All of the data on the screen is plotted.
TRACE ; Only wave form on the screen is plotted.

Division : 1 ; The plot is carried out to the full size of the paper.
2 ; The plot is carried out on the two part split size.
4 ; The plot is carried out on the four part split size.

Locate Mode : AUTO ; Location can be moved automatically.
At the two part split size.
Left→Right→Left
At the four part split size.
UpLeft→UpRight→LowLeft→LowRight→UpLeft

MANUAL ; Location cannot be moved automatically.

Location : Plot is set for the split plot.

GPIB Mode : TALK ONLY ;Talk only mode is set.

ADDRESSABLE ; Addressable mode is set.

Plotter Address : When addressable mode is set for the Spectrum Analyzer, specify the address of the connected plotter.
Moreover, also specify the same address for the connected plotter.

Output to the plotter

Press COPY key then output to the plotter is started.
The output data is the data of the display at the time when COPY key is pressed.
Operation of the panel key is available after output is started.
(it is not necessary to wait after the completion of plot.)
Even if the panel key is pressed during plotting, but the output data in not change.

Note

Even if COPY key is pressed again during plotting but this plot requirement is omitted.

Cancel for the plot output

If the key in order of [SHIFT ●] , [CONFIG COPY] and [Copy Cancel]

Plotter are pressed then plot output is canceled.
However, if the plotter has the buffer memory then the stored data in the buffer memory is plotted.

Table 6-5 Plotter paper size

Plotter model	Paper size
HP7470A	A4 (ISO A4)
HP7440A	A4 (ISO A4)
HP7475A	MET A4 (ISO A4)
HP7550A	MET A4 (ISO A4)
R9833	A4 Landscape

Table 6-6 Assignment of the plotter pen

Pen number	Paper size
Pen 1	Frame
Pen 2	Marker and characters
Pen 3	Trace A
Pen 4	Trace B
Pen 5	Display line
Pen 6	
Pen 7	Windows
Pen 8	Limit line

4. Output to the File

The screen data can be output to the memory card in the bit map file format which is adapted by Microsoft Windows.

CAUTION !
Drive lamp indicates the red color during accessing for the memory card.
Do not eject the memory card during drive lamp indicates the red color.
If the memory card is ejected during drive lamp indicates the red color then the data in the card does not ensure.

■ Specifying the data output

1 **Press the keys in order of** SHIFT [●], CONFIG [COPY] **and** [File].

Following dialog box is displayed.

File				
File Format :	BMP			
Copy Mode :	Color	Gray	Mono	
Compression :	OFF	ON		
File No. :	001	Filename: \IMG\ADV001. BMP		
Auto Increment :	OFF	ON		

2 **Select desired item by step key and set the data by keypad or knob.**

Copy Mode : Color ; Color bit map data is output.
Gray ; Bit map data of monochrome with 4-step gradation is output.
Mono ; Bit map data of monochrome without gradation is output.

Compression : OFF ; Bit map data is not compressed and is output.
ON ; Bit map data is compressed and is output.

CAUTION !

If the compressed bit map data is displayed using by the graphic view of the application software on the personal computer then it needs to have decompression function. Some application software does not support for the compressed bit map data.
In this case, use non-compressed bit map data.

File No. : Number (3-digit) of the file to be output is set.
File is output by the file name which is displayed at the right-side of the set number.

Auto Increment : OFF ; File number is not updated.
ON ; File number is updated automatically.

■ Output to the file

When the data is output to the A or B drive, press COPY key then it is started.
The output data is the display at the time when COPY key is pressed.
Operation of the panel key is available after output is started.
(it is not necessary to wait after the completion of output.)
Even if the panel key is pressed during outputting, but the output data is not change.

Note

Even if COPY key is pressed again during outputting but this output is omitted.

File is output to the /IMG directory in the selected drive and the file name is ADVxxx with extensions (xxx is a file name).
The /IMG directory is created automatically.
Extensions of output file is shown in the following table.

Table 6-7 File extension

Compression	Extensions
OFF	.BMP
ON	.RLE

Cancel for the file output

If the key in order of SHIFT [●], CONFIG [COPY] and [Copy Cancel]

then file output is canceled.

File size

Screen data in the bit map file is output then the file size becomes as shown following table.

Table 6-8 Output File Size

Copy Mode	Compression	File size (kbytes)
Color	OFF	300
	ON	30 to 70
Gray	OFF	150
	ON	30 to 70
Mono	OFF	38

CAUTION !
File size of compression ON exceeds the values in the above table because of the compressed files size vary by displayed data.

5. Setup for the Target Device of the Screen Data Output

Printer, plotter and memory card can be selected for the target device of the screen data output.
Setup of the target device.

Setup of the target device

1 **Press the key in order of** SHIFT [●], CONFIG [COPY] **and** [Copy Cancel].

Following dialog box is displayed.

Copy Device
Printer
Plotter
A
B

2 **Select desired item by data knob and press the data knob for setup.**

Printer : The data is output to the printer.

Plotter : The data is output to the plotter.

A : The data is output to the memory card of A drive.

B : The data is output to the memory card of B drive.

CHAPTER 7

Function Descriptions

This chapter explains basic and applied functions. For menu list, see Section A.3.

CONTENTS

1. Functions of Fundamental Keys 7-2
2. Functions of FORMAT Mode 7-20
3. Functions of MARKER Section 7-32
4. Functions of SWEEP Mode 7-45
5. Functions of MEASUREMENT Section . 7-52
6. Save Function 7-65
7. Recall Function 7-73
8. Calibration Function 7-76
9. System Functions 7-79
10. Window Function 7-81

1. Functions of Fundamental Keys

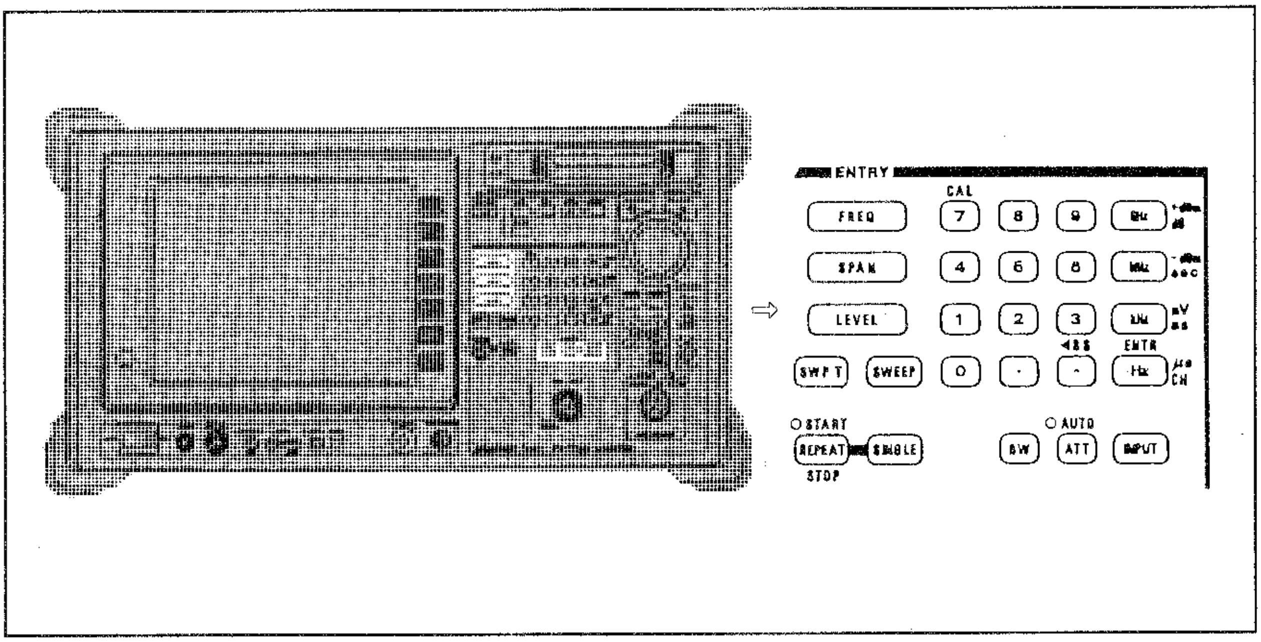
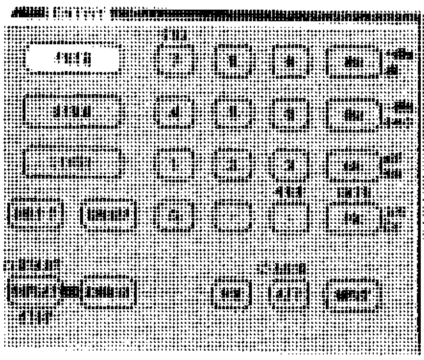


Figure 7-1 Functions of Fundamental Keys on the Front Panel

Center Frequency



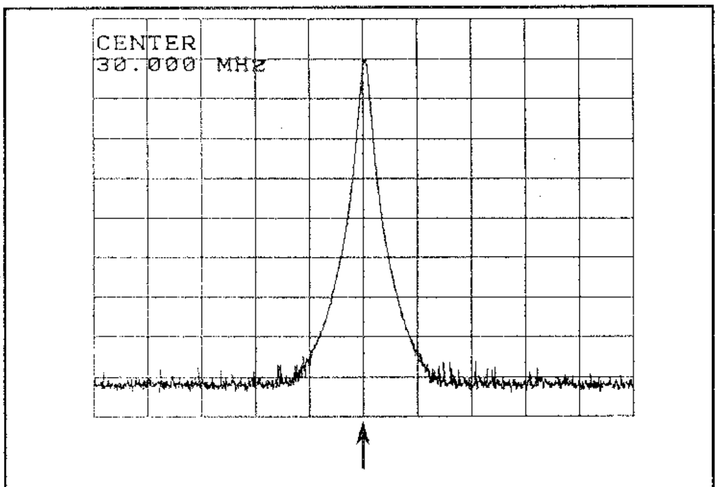


Figure 7-2 Center Frequency Display

FREQ	Sets the center frequency setting mode. Pressing this key enables data entry and displays center frequency data (0 to 26.5 GHz) on the screen.

Table 7-1 Display Resolution of Center Frequency

Display Resolution of Center Frequency	
1 MHz	Span ≧ 1000 MHz
100 kHz	1000 MHz > Span ≧ 100 MHz
10 kHz	100 MHz > Span ≧ 10 MHz
1 kHz	10 MHz > Span ≧ 1 MHz
100 Hz	1 MHz > Span ≧ 100 kHz
10 Hz	100 kHz > Span ≧ 10 kHz
1 Hz	10 kHz > Span ≧ 2 kHz
1 Hz	Span = 0 Hz

Note

Higher resolutions are rounded off in the displayed.

● **Explanation of Center Frequency Menu**

FREQ

Center	Sets the center frequency setting mode.
Start	Sets the start frequency setting mode. The start frequency can be set in the range of 0 to 26.5 GHz. (Initial value is 0 Hz.)
Stop	Sets the stop frequency setting mode. The stop frequency can be set in the range of 0 to 26.5 GHz. (Initial value is 26.5 GHz)

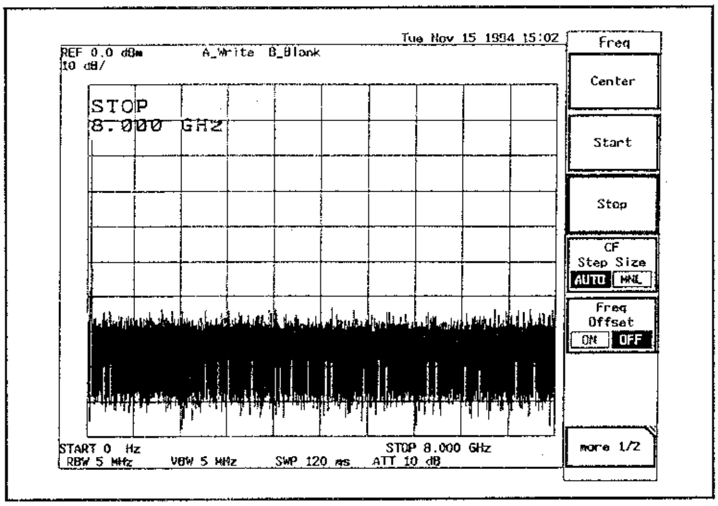


Figure 7-3 Start/Stop Frequency

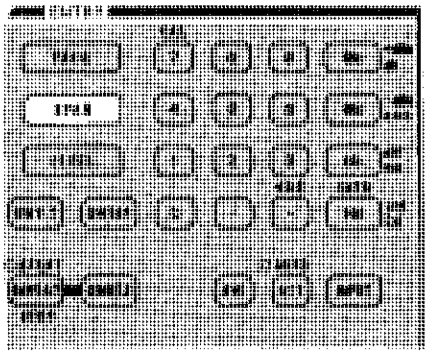
CF Step Size [AUTO][MNL]	When MANUAL is selected, step size of the center frequency can be set. In MANUAL, data can be entered and the step size data of the center frequency is displayed on the screen. In AUTO, the step size is set to 1/10 of the frequency span.
Freq Offset [ON][OFF]	When ON is selected, an offset frequency can be set in the range of 0 to ±100,000 MHz. If a value less than the display resolution is entered, it will be replaced with the value of the display resolution.

Center frequency (displayed)
= Center frequency (set) + Offset

When OFF is selected, the offset is canceled.

Signal Ident [ON][OFF]	When an external mixer is used, multiple spectra are displayed for one input signal according to multiple responses because preselector is not provided. Setting SIGNAL ID functions to identify a true signal at every sweep. In the true signal, the display position of the spectrum is not changed.
more 1/2	Displays menu on the following page.
Presel Tune	Adjusts a tracking between the sweep frequency of the preselector embedded in the input part and the sweep input frequency in the input frequency range of 3.0 to 26.5 GHz. When the baseband frequency (0 to 3.0 GHz) is in the set frequency range, this function does not operate. And neither in EXT MIXER.
AUTO Peeking	Automatically adjusts the tracking of the preselector so that the signal level indicated by a marker is maximum. Use this function after positioning a marker near the peak of a desired input signal.
Manual Peeking	It is possible to adjust the tracking of the preselector manually (with ten keys, a data knob and step keys).
more 2/2	Returns to the menu on the previous page.

■ Frequency Span



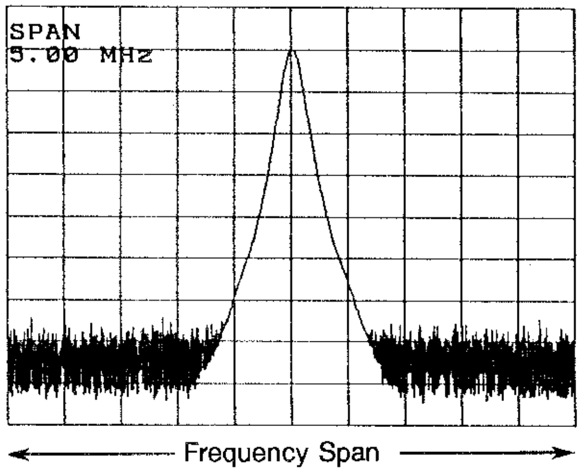


Figure 7-4 Frequency Span

SPAN

Sets the frequency span setting mode.
In this mode, data can be entered and frequency span data is displayed on the screen.

Table 7-2 Display Resolution of Frequency Span

Display Resolution of frequency span	
10 MHz	Span > 4000 MHz
1 MHz	4000 MHz ≧ Span > 400 MHz
100 kHz	400.0 MHz ≧ Span > 40.1 MHz
10 kHz	40.00 MHz ≧ Span > 2.01 MHz
1 kHz	2.000 MHz ≧ Span > 401 kHz
100 Hz	400.0 kHz ≧ Span > 20.0 kHz
10 Hz	20.00 kHz ≧ Span > 2.00 kHz
1 Hz	2.000 kHz = Span

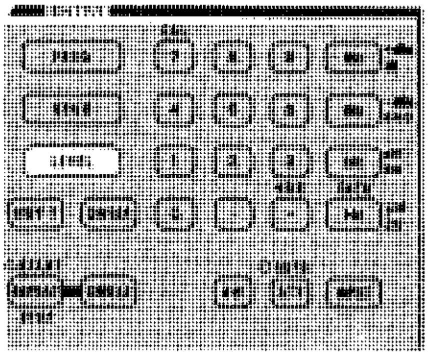
Explanation of Frequency Span Menu

SPAN

Full Span	Automatically sets a 13.25 GHz center frequency, 26.5 GHz span.
Zero Span	The frequency is fixed to the center frequency. The analyzer operates as a tuned receiver. The horizontal axis becomes a time axis. The center frequency resolution is determined according to the set resolution bandwidth.

Reference Level

Reference level
(Initial value = 0 dBm)



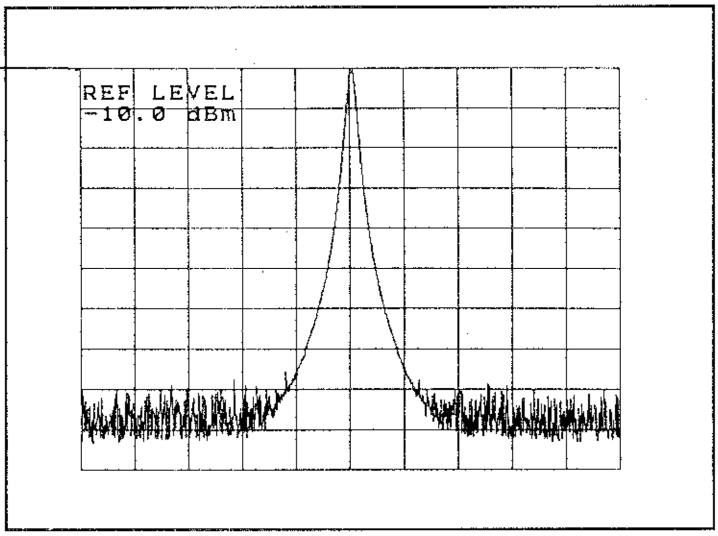


Figure 7-5 Reference Level

Explanation of Reference Level Menu

LEVEL

Reference level can be set in the range of -105 dBm to +60 dBm.

CAUTION!
The reference level is restricted by the input attenuator that is in MANUAL or by the setting value of Min ATT and its setting range may be narrower than the range from -105dBm to +60dBm.

dB/Div

The vertical amplitude scale can be set from 10 dB/div to 0.5 dB/div.

Key	Description
10dB/DIV	Sets 10dB/div.
5dB/DIV	Sets 5dB/div.
2dB/DIV	Sets 2dB/div.
1dB/DIV	Sets 1dB/div.
0.5dB/DIV	Sets 0.5dB/div.
return	Returns to the preceding menu.

Key	Description
Linear	Reference level data are indicated in voltage on the screen. Since conversion is made from a dBm unit scale, some slight error can arise.

Key	Description
× 1	Displays data between 0 V and REF level linearly. Data are displayed in (REF level/10)/div form.
× 2	Data display is scaled up twice on a base of REF level. Data are displayed in (REF level/20)/div form.
× 5	Data display is scaled up five times on a base of REF level. Data are displayed in (REF level/50)/div form.
× 10	Data display is scaled up ten times on a base of REF level. Data are displayed in (REF level/100)/div form.
return	Returns to the preceding menu.

Units		The units for the reference level, the display line and the marker level can be selected from the following menu.
	dBm	
	dBmV	dBm + 47 dB
	dBμV	dBm + 107 dB
	dBμVemf	dBm + 113 dB
	dBpW	dBm + 90 dB
	Watts	$10^{\frac{dBm}{10}}$ mW
	Volts	
Ref Offset ON / OFF		When ON is selected, the offset level of the reference level can be set in the range of 0 to ±100.0 dB in logarithmic (dB) scale only. When OFF is selected, the offset is canceled.

Reference level (displayed)
= Reference level (set) + Offset

■ Resolution Bandwidth (RBW)

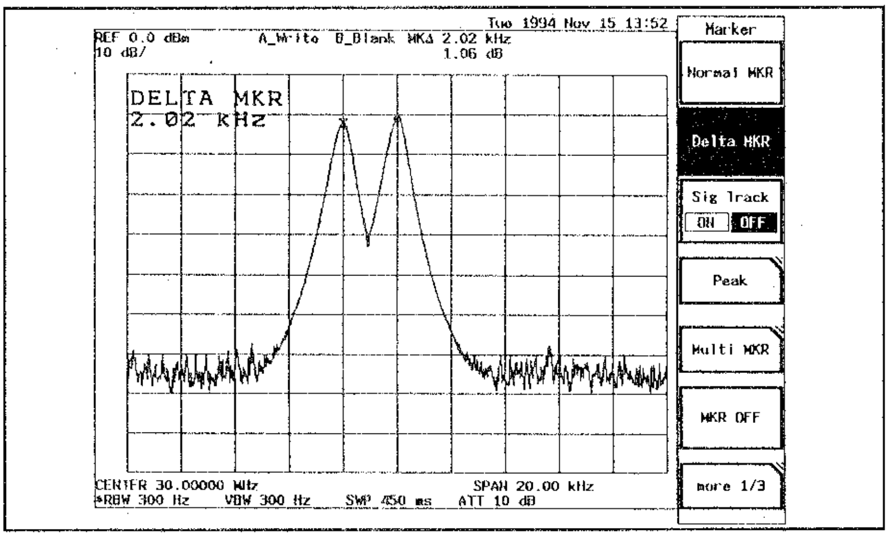


Figure 7-6 RBW : Maximum IF Bandwidth which can separate two Signals

When RBW is set very narrow, the resulting spectrum is also very fine in detail and has increased resolution of the spectral components. Thus, it is possible to separate a signal from neighboring noise, or two closely spaced spectral components. But as RBW is decreased, it takes an increasing amount of time to sweep through the same frequency range. If the sweep speed is too fast, the signal level measured at each frequency drops and an UNCAL message appears on the screen.

BW

RBW [AUTO | MNL] — RBW can be set from 300Hz to 5 MHz (from one to three step). Initial setting is AUTO and an optimum RBW is set corresponding to the frequency span. (In the case that RBW is set in 200Hz, the accuracy of the band, the accuracy of the level and the noise level have no regulation. The display image is "!RBW 200Hz" in this case.)

RBW : Span — Sets RBW ratio corresponding to the span. When RBW is set to AUTO, RBW is automatically set corresponding to the span at the ratio specified here. The ratio can be set from 0.1 to 0.001. Initial setting is 0.01.

Set Default — Resets RBW to the initial setup state.

return — Returns to the preceding menu.

■ Video Bandwidth (VBW)

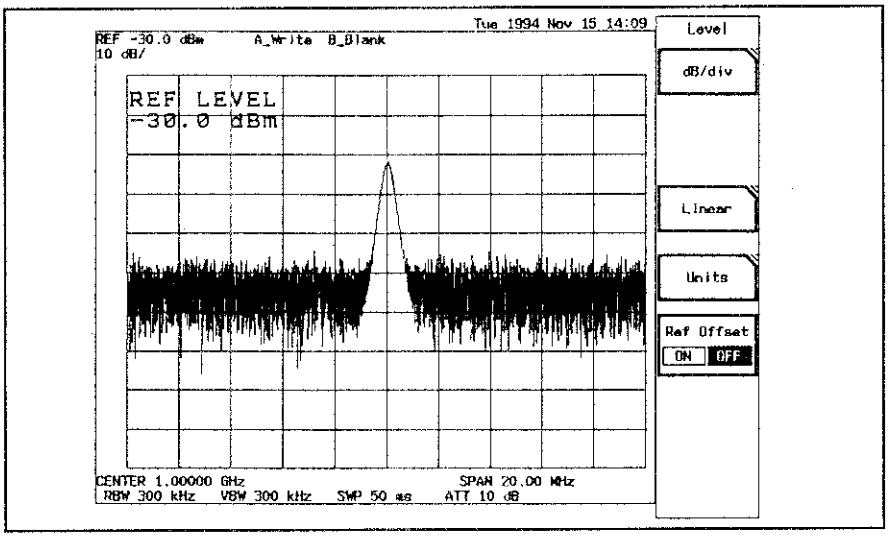


Figure 7-7 VBW = 300 kHz

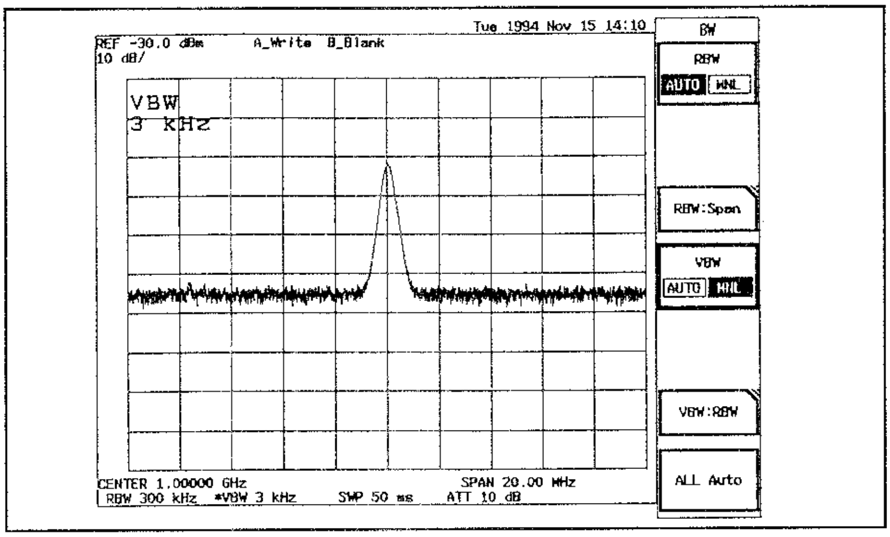


Figure 7-8 VBW = 3 kHz

VBW is used to average the input signal to reduce the noise on the signal or to reduce the noise floor. This can be useful when searching for a signal buried in noise, etc. Noise averaging is done by low pass filtering the signal. S/N ratio is improved by approximately 10 dB.
To do this noise averaging most effectively, VBW must be chosen based on the RBW setting. (Generally, a VBW of 1/10 or less of the RBW is desirable.)
If the VBW is set too narrow, the spectral levels measured will decrease from their true values because of the low pass filter time constant and UNCAL message will appear on the screen. In such a case, increase the sweep time.

BW

VBW (AUTO / MNL)	VBW can be set in the range of 1 Hz to 5 MHz(1-3 step). Initial setting is AUTO, RBW = VBW.
VBW : RBW	Sets VBW ratio corresponding to RBW. When VBW is set to AUTO, VBW is automatically operated according to the span at the ratio specified here. The setting value is 1,3 step from 3 to 0.003. The initial setting value is 1.
Set Default	Resets VBW to the initial setup state.
return	Returns to the preceding menu.

■ Selecting AUTO of Coupled Functions

BW

All Auto	Pressing this softkey sets all of the coupled functions (RBW, VBW and SWEEP TIME) to AUTO based on the current span setting.

Input Attenuator (ATT)

ATT is used to protect the instrument input section from damage; to attenuate the input signal amplitude to a level where it can be measured easily; and finally to reduce undesirable distortions that could affect measurements.

ATT can be set in the range of 0 to 70dB. However, the value less than the Min ATT cannot be set.

Initial setting is Auto (10 dB). In AUTO mode, an optimum attenuation is automatically set depending on the reference level.

ATT

Min ATT AUTO MNL

Min ATT — Minimum attenuation value is set in the Min. ATT menu for Auto and Manual range. The minimum attenuation value is limited to 10dB, so, 0dB cannot be set for Auto range.
For manual attenuation, 0dB range can be set.
When Default is selected, the minimum ATT is set to 10 dB.
This function is used to protect the input from damage and to minimize errors with level and distortion measurements.

Example :

- For the level measurement, set Min ATT so that the mixer input level will be -10 dBm or less.
  (Min ATT ≧ Signal level + 10 dB)
- When distortion is measured, set [Min ATT≧ Signal level + 30dB].
  In the case of under the lower limit frequency of preselector, set [Min ATT ≧ Signal level + 10dB].

Set Default — Resets Min ATT as the initial setup state.

return — Returns to the preceding menu.

Input Key

Input

Offset [ON] [OFF]	Sets the offset of reference level in the range from 0 to +/-100 dB. Display reference level = Reference level (set value) + Offset ***Example :*** This function is convenient when a fixed attenuator is connected to the input for measuring a high power signal. For example, when +30 dBm signal is measured with a 20 dB fixed attenuator inserted, screen display becomes +10 dBm. When the offset of reference level is set to "+20 dB", +30 dBm can be read for the measured signal.
Mixer [INT] [EXT]	Internal mixer and external mixer can be switched. INT: A signal from the RF input connector is measured by using the internal mixer. EXT: A signal is measured with the connected external mixer. The center frequency can be set in the range of 12.4 to 325 GHz.
EXT MIX Config	Sets conditions for external mixer.
Signal Ident [ON] [OFF]	When an external mixer is used, multiple spectra are displayed for a single input signal because no preselector exists. When this function is turned ON, identification is made for each sweep, so that the spectrum of true signal does not change.
Correction Factor	The level correction is executed for each specified frequency.

● Setting of External Mixer Condition

Input → EXT MIX Config

Bias (Nega / Posi)

Adjusts the bias of mixer in Nega mode when the bias of external mixer is negative, while in Posi mode when positive.
The bias setting can be entered with the data knob, step keys, ten keys, and the ENTER key or other unit keys. The set value is displayed in units of mA on the active area in the upper left of the screen.

Band Select

Sets the frequency bandwidth of the external mixer to be used. The available frequency bandwidth is shown in Table 7-3.
The data knob, step keys and numeric keys can be used to set the value. If you use numeric keys, select a BAND NO. from Table 7-3 below.
The set value of BAND NO. and mixing degree (N) are displayed on the active area in the upper left of the screen.

Table 7-3 Range of Frequency Bandwidth for External Mixer

BAND No.	Frequency range (GHz)	Mixing degree (N)
1	12.4 to 18.0	3
2	17.0 to 26.5	4
3	22.0 to 33.0	5
4	26.5 to 40.0	6
5	33.0 to 50.0	8
6	40.0 to 60.0	8
7	50.0 to 75.0	10
8	60.0 to 90.0	12
9	75.0 to 110.0	14
10	90.0 to 140.0	18
11	110.0 to 170.0	22
12	140.0 to 220.0	28
13	170.0 to 260.0	34
14	220.0 to 325.0	42

Band Lock [ON | OFF]

When ON is selected, the frequency bandwidth is fixed to what selected in the Band Select mode. The center frequency and start/stop frequency can be set within the selected frequency range.

When OFF is selected, a frequency band is automatically selected from Table 7-3 according to the input center frequency and start/stop frequency.

AVG Loss [ON | OFF]

Average conversion loss of the external mixer can be entered with the numeric keys and [GHz +dBm/dB], [MHz -dBm/sec] key.

When ON is set, the conversion loss that is input to the measurement result can be compensated.

Loss:Freq [ON | OFF]

When OFF is selected, this mode is canceled.

When ON is selected, compensation is made at the value entered in the "Loss:Freq Edit" mode.

Loss:Freq Edit

Displays a table and a menu used to input conversion loss at the Returns to the preceding menu. frequency of the external mixer to be used.

return

Returns to the preceding menu.

● Input of External Mixer Compensation Data

INPUT → EXT MIX Config → Loss:Freq Edit

A window is displayed and data can be entered. The data display can be scrolled with the data knob and step keys.

Input INSERT OVERWRT	Input mode and Modify mode can be switched. Object item of input/modification is marked with an underline. In the input mode, frequency, level and bias current is entered in the order. Entering these three data determines data for one point. The input data are sorted on a base of frequency in ascending order. In the Modify mode, the input data are modified and sorted on the base of frequency and level each. To set frequency, level and bias current, press their unit key after entering numeric values. (For the bias current, Use the Hz key or other.)
Cursor Change	Data to be input is switched among frequency, level and bias.
Delete Line	Deletes a cursor positioned line.
Table Init	Deletes all input data.
return	Returns to the preceding menu.

Correction Factor Function

INPUT → Correction Factor

The correction factor function corrects the level in the specified frequency range.
The maximum points of frequency in which the level is corrected is 51 points. The level to be corrected is set in dB.
The corrected level of the not specified frequency is calculated with linear interpolate method.
The character "CFa" is displayed on the left upper side of the scale when the correction function is turned ON.

Correction ON | OFF
Selects "ON/OFF" of the Correction function.

Correction Edit
Displays the sub menu to execute the Correction table data.

Input INSERT / OVERWRT
Switches the input mode (INSERT) and the changing mode (OVERWRT) of the table data.
It is input in order of the frequency and the level in the input mode. In the changing mode, the data that has been input can be changed.

Cursor Change
Switches the input items (frequency and correction level).

Delete Line
Deletes the marked line.

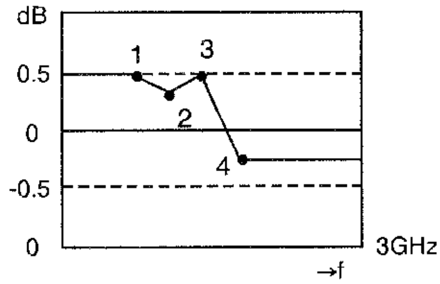
Table Init
Erases the correction table data.

return
Returns to be preceding menu.

return	Returns to the preceding menu.

<Example of the Table Data and the relationship of the level to be corrected>

1.	810.00MHz	+0.50dB
2.	950.00MHz	+0.30dB⇒0Hz
3.	1030.00MHz	+0.50dB
4.	1700.00MHz	−0.25dB

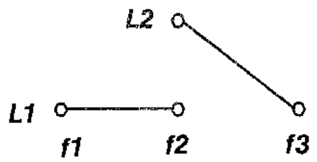


Note

1. ***Input correction data is sorted in increasing order of frequency.***
2. ***If two correction levels are set for the same frequency, a first-set correction level is effective. (In the example (1), the correction value of f2 is L1, and L1 in the example (2).)***
   Further, if three or more correction levels are set for the same frequency, only the first and last data are effective.

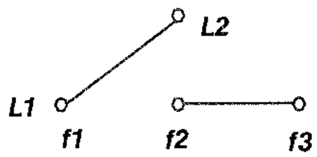
(1)

1. f1 L1
2. f2 L1
3. f2 L2
4. f3 L1



(2)

1. f1 L1
2. f2 L2
3. f2 L1
4. f3 L1



2. Functions of FORMAT Mode

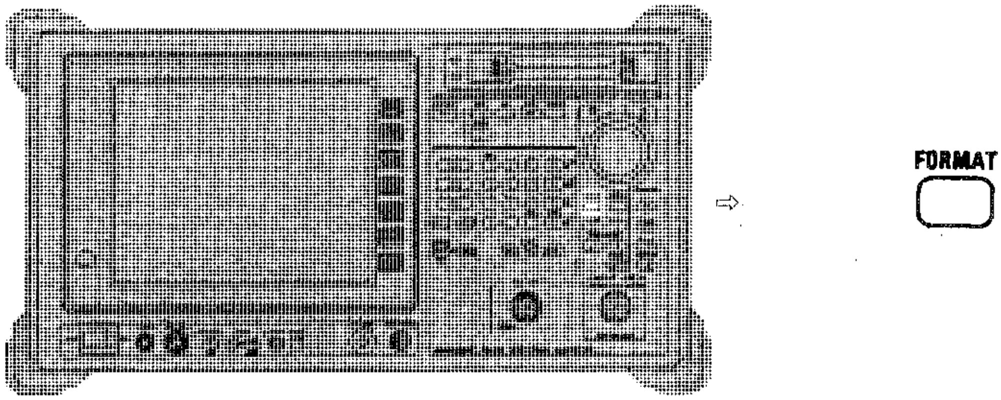


Figure 7-9 FORMAT Key on the Front Panel

FORMAT

Trace	Displays trace softmenu.
Trace Detector	Displays a menu to set the detector.
Display Line ON OFF	Display line is a horizontal line for comparing waveform levels. When turned ON, display position can be changed with data knob, step key or ten-key.
Limit Line	Displays a limit line creating menu. Frequency data and time data are chosen according to the spectrum analyzer setting.
Label	Inputs a label.

■ Functions of TRACE mode

The instrument provides two trace memories, A and B.
The A memory has two modes. In the Write mode, the new data from each sweep writes over the data from the previous sweep. In the View mode, waveform can be stored and displayed on the screen.
The B memory has only the View mode for storing and displaying the waveform. Once a waveform has been stored in B memory, it can be manipulated with any of the many built-in waveform calculation functions, and can be used for making various waveform comparisons.
The input signal first goes through the RF/IF section. Next it is detected with a LOG/LIN amplifier, and then converted with an A/D converter. The digital data is then stored into the trace memory, where is can be controlled by the CPU, and finally displayed on the color LCD display.

CAUTION !
The B memory does not have a Write mode in which the new data from each sweep overwrites the previous memory data.
Before performing comparison of two waveforms, store the trace data into the B memory (Store B) once.

● **Modes of Trace A (Does not apply to the trace B)**

FORMAT → Trace

Write A — Sets the Write mode.
The new data from each sweep updates the A memory and is displayed on the screen.

View A — Sets the View mode.
Stops the Write updating operation; and holds and displays the trace data on the screen.

When the View A mode is set, the contents of the A memory are displayed on the screen.

Blank A — Sets the Blank mode.
Blank mode : Erases the trace data.

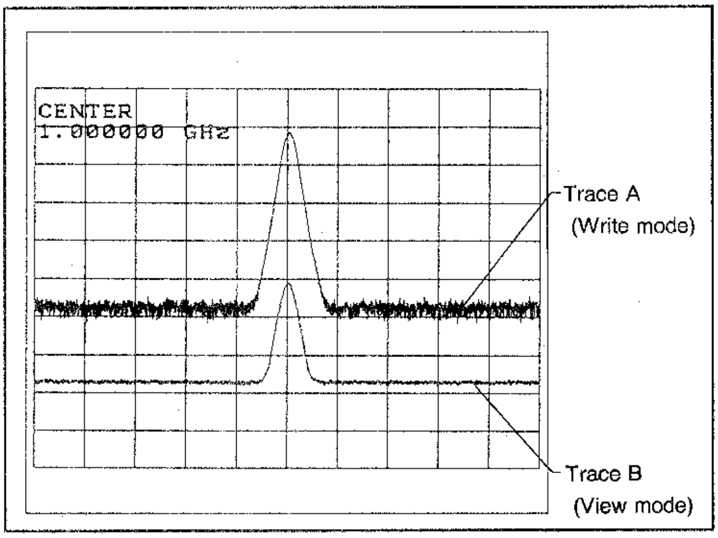


Figure 7-10 Write Mode and View Mode

Max Hold A

Max Hold A: Sets the Max Hold mode. (Not available for the Trace B)
Compares the new data for each horizontal axis point with the previous data on each sweep and displays the trace data with the larger value. Thus, the display accumulates the maximum values for each point in the horizontal axis.

Press this soft key again or Write A key to cancel Max Hold mode.

CAUTION !
Selecting this mode automatically forces the positive detection mode.

Trace Math

● **Averaging Mode (Available only for the Trace A)**
Averaging can be used to improve S/N in a shorter time than video bandwidth filtering for noise reduction.
With averaging it is possible to recover signals buried in noise, or quantified signals with a random component.

CAUTION !
Selecting the averaging mode automatically forces the Sample detection mode.

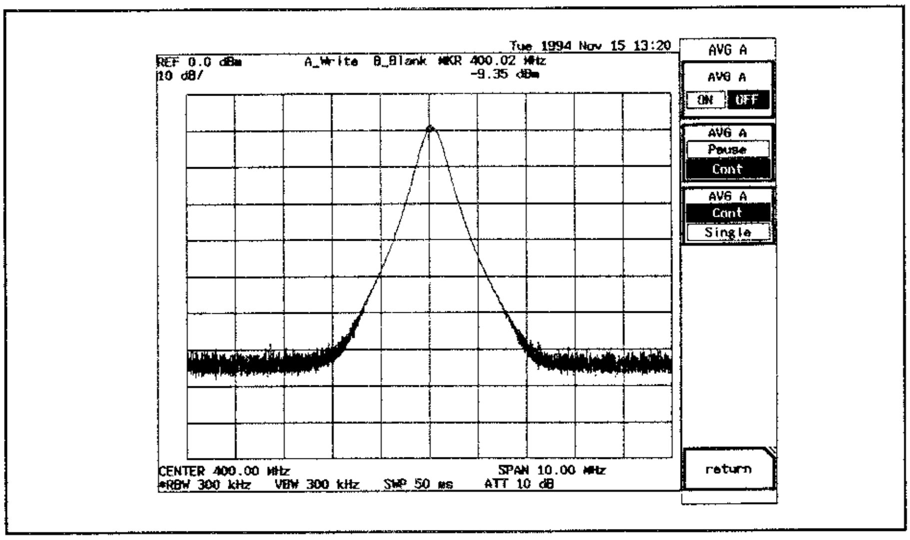


Figure 7-11 No Averaging

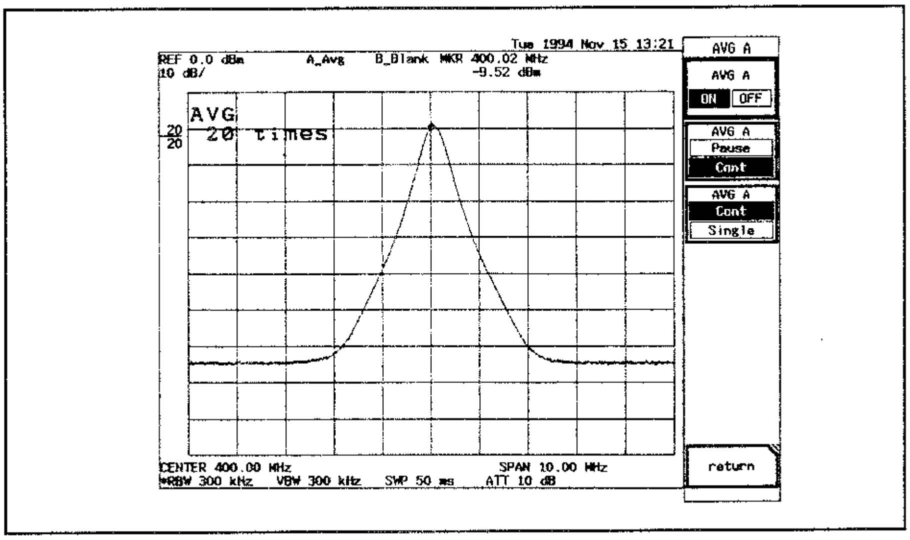
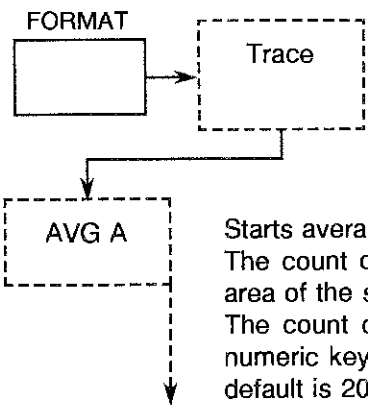


Figure 7-12 After Averaging 20 Times



Starts averaging.
The count of the averaging is displayed in the active area of the screen.
The count can be set to a value from 2 to 999 with numeric keys, step keys or the data knob. (The initial default is 20.)

AVG A
ON | OFF

AVG A
Pause
Cont

Setting Pause during averaging stops averaging temporarily and displays the averaging count at this time in the active area of the screen.
Pressing this softkey again to set Cont starts the averaging from the point where it was paused.

AVG A
Cont
Single

When Cont is set, even after the desired averaging count has been reached, averaging will be repeated continuously using algorithm 2.

When Single is selected, as soon as the desired averaging count has been reached the analyzer will automatically leave the averaging and sets to the View mode.

[Averaging Algorithms]

[N ≧ n] : Algorithm 1

$$\overline{Yn} = \text{Sigma}/n$$

[N < n] : Algorithm 2

$$\overline{Yn} = ((N-1)\cdot\overline{Yn\text{-}1})/N + Yn/N$$

n:	Current averaging count
N:	Averaging count specified
Yn:	Trace data for nth average
$\overline{Yn}$:	Averaged data for nth average
$\overline{Yn\text{-}1}$:	Averaged data for n-1th average
Sigma:	Sum of all the data up to the nth average

return

Returns to the preceding menu.

● **Modes of Trace B**

FORMAT → Trace

Trace B	Displays the Trace B setup menu. Note that Trace B does not have a Write mode. This mode is used for two waveforms comparison.
Store B	Stores the Trace A data to the B memory, and sets View B mode.
View B	Displays the data stored in the B memory as Trace B on the screen.
Blank B	Erases the Trace B data from the screen and holds the data stored in the B memory until the Store B key is pressed again.
Trace A	Displays the Trace A setup menu.
Trace Math	Displays the operation mode menu.

● Operation modes

Trace Math

Min Hold

The data for each point on frequency axis are compared with new data each time sweep is executed, and smaller one is stored in the memory and displayed on the screen. Therefore, the waveform becomes the time series trace of minimum values. In this mode, trace detection mode is automatically set to NEGA.

A↔B

Exchanges the content of memory A with that of memory B.
Or exchange the content of trace A with that of trace B.

A-B→A

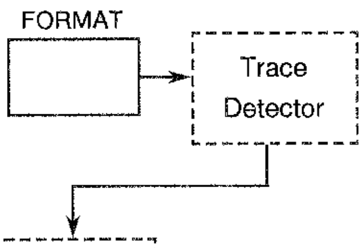
For each point, displays the result of subtracting the value of memory B from that of memory A. The content of memory B is subtracted from that of memory A or the result of sweep, and the subtraction result is stored in memory A.
For A VIEW or B BLANK, the content of memory B is subtracted from that of memory A, and the result is stored in memory A. When trace A is not VIEW or BLANK, the content of memory B is subtracted from the result of sweep, and the subtraction result is stored in memory A.

B-A→A

For each point, displays the result of subtracting the value of memory A from that of memory B. The content of memory A or the result of sweep is subtracted from the content of memory B, and the subtraction result is stored in memory A.
For A VIEW or A BLANK, the content of memory A is subtracted from that of memory B, and the result is stored in memory A. When trace A is not VIEW or BLANK, the content of memory B is subtracted from the result of sweep, and the subtraction result is stored in memory A.

A-DL→A	For each point, displays the result of subtracting the value of display line from that of memory A. The value of display line is subtracted from the content of memory A or the result of sweep, and the subtraction result is stored in memory A. For A VIEW or A BLANK, the value of display line is subtracted from the content of memory A, and the result is stored in memory A. When trace A is not VIEW nor BLANK, the value of display line is subtracted from the result of sweep, and the subtraction result is stored in memory A.
return	Returns to the preceding menu.

Explanation of Detector Mode Menu



Posi-Nega	Selects the normal (Posi/Nega) detection mode.
Posi	Selects the positive peak detection mode. This mode is useful for level measurement of fine spectrum and PULSED RF signal measurement because peak of the spectrum can be detected certainly. In the Max Hold mode, this mode is automatically set.
Nega	Selects the negative peak detection mode.
Sample	Selects the sample detection mode. This mode is automatically selected for noise level measurement (dB/Hz) with a marker and for video averaging mode.
return	Returns to the preceding menu.

■ Explanation of Limit Line Menu

Note

When the limit line is displayed in the CW mode, the judgment of Pass or Fail is carried out every measurement sample.

FORMAT → Limit Line

Limit Line Edit	Displays the sub menu to execute of the limit line table data. At this time, the time domain limit line table is displayed if it is in SPAN 0 Hz and the frequency domain limit line table is displayed if it is not in SPAN 0Hz.
Limit Line [1] [2]	Switches the limit line 1 and 2.
[INSERT] [OVERWRT]	Selects the insert mode (INSERT) or the overwrite mode (OVERWRT).
Cursor Change	Toggles between frequency, time or level.
Delete Line	Deletes the line on which the cursor is placed.
Table Init	Initializes the table data of the limit line.
return	Returns to the preceding menu.

Key	Function
X [ABS][REL]	Switches absolute data display and relative data display of the frequency data if it is not in SPAN 0Hz. Switches absolute data display and relative data display of the time data if it is in SPAN 0 Hz. The relative data display is based on DELAY TIME when DELAY SWEEP is turned ON.
Y [ABS][REL]	Switches absolute data display and relative data display for the level data. The display line is a basis for marker relative data display.
Shift [X][Y]	Shifts the entered frequency (or time) data or level data.
Limit Line 1 [ON][OFF]	Switches ON and OFF the limit line 1.
Limit Line 2 [ON][OFF]	Switches ON and OFF the limit line 2.
Copy Table	Copies a data table of the limit line.
Copy Table 1 to 2	Copies a data table of the limit line from 1 to 2.
Copy Table 2 to 1	Copies a data table of the limit line from 2 to 1.
return	Returns to the preceding menu.

Label Function

Label input is performed for the waveform display. The documentation text can be used for a plotter output and a memory card function.

Labeling Procedure

1 **Press the FORMAT key and the Label key in the order.**

The label input screen (Figure 7-13) is displayed and a label can be entered.

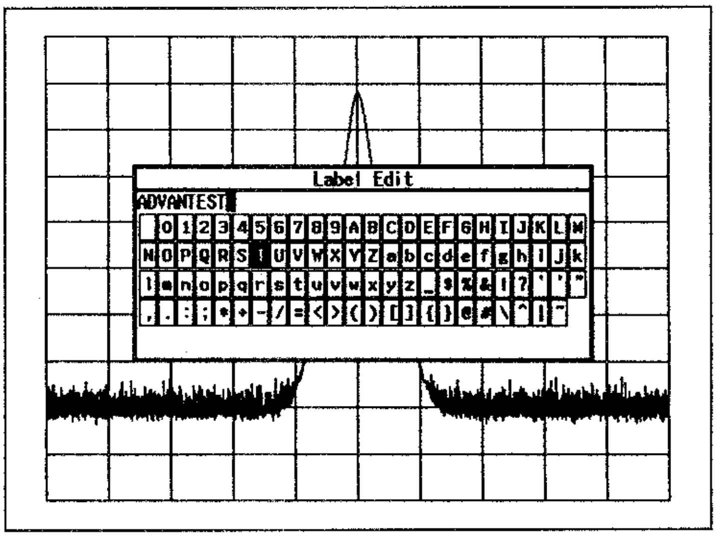


Figure 7-13 Label Input Screen

2 **With step key and data knob, set characters.**

Pressing the step key moves the cursor vertically.
Turning the data knob moves the cursor horizontally.
Pressing the data knob defines the input characters.

CAUTION !

Press B·S [-] key to correct or delete the input characters.

3 **Press ENTER [Hz] key to input characters.**

3. Functions of MARKER Section

Normal marker and △ marker can be placed on the frequency being displayed, and the frequency and the level data at that point are displayed.

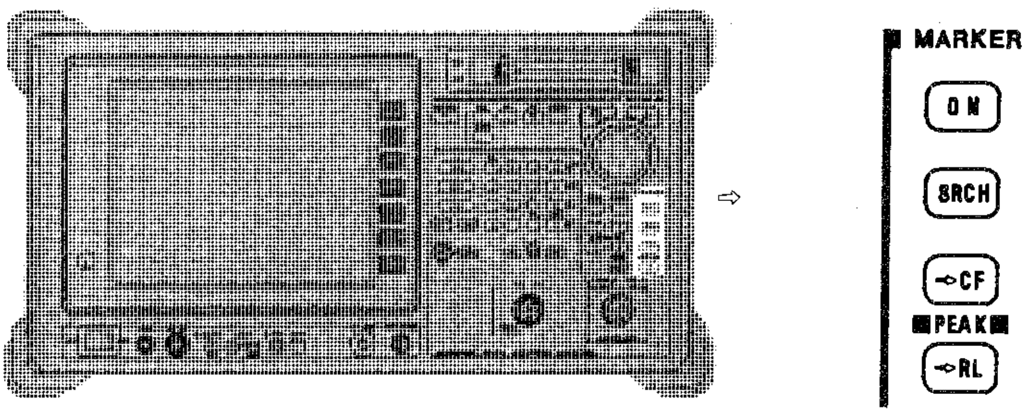


Figure 7-14 MARKER Section Key on the Front Panel

■ Marker ON

● Normal Marker and △ Marker

MARKER

ON

Pressing the "ON" key turns the marker ON: the marker (◆) is shown on the waveform, and the frequency and level parameters at the marker position are displayed on the screen.
The marker can be moved with the numeric keys and units keys, the step keys and the data knob.

Normal MKR

Displays the normal marker (◆).

Delta MKR

Displays the △ marker (⧗) at the same place as the normal marker. The relative differences between △ marker and normal marker in frequency and level are displayed in the marker area.
Data input for the frequency difference between the two markers can be made with the numeric keys and units keys, step keys and the data knob.
Doing so, the normal marker moves with △ marker fixed.

Signal Track Mode

In this mode, the peak level of the signal on which a marker is displayed is detected on each sweep, and then the center frequency is moved to that frequency. This is useful to track and analyze the signals with drifting frequency. The condition for detecting a signal is dependent on the "PEAK △ Y div" setting.

MARKER
ON

↓

Sig Track
ON OFF

When ON is selected, the signal track mode is set.
If the span is set to narrow in the signal track execution, span can be changed in steps by the AUTO ZOOM function. However, AUTO ZOOM functions only when span is changed with numeric keys and units keys.

When OFF is selected, the signal track mode is canceled.

Peak Search

SRCH

Finds the highest level of the waveform being displayed, and moves the marker there. Displays that frequency and level.
If a measurement window is ON, then the peak search is performed in side the window.

- **Explanation of Next Peak Search Menu**

MARKER
ON → Peak

↓

Next Peak

Moves the marker to the next higher peak from the current marker position.

Next Peak Left	Moves the marker to the peak with the next lower frequency than the current marker point.
Next Peak Right	Moves the marker to the peak with the next higher frequency than the current marker point.
Min Peak	Moves the marker to the lowest level of the waveform being displayed.
Next Min	Moves the marker to the next lowest level than the current marker point in increasing level order.
Cont Peak ON OFF	Enables continuous peak searching. When ON is selected, a peak search is done after every sweep, and the frequency and the level are displayed. When OFF is selected, the continuous peak search is canceled.
more 1/2	Displays menu on the following page.
Peak Delta Y	Sets the amplitude condition for next peak search. For further details, refer to Page 7-35.
Search ALL Up Low	Changes the peak search level. For further details, refer to Page 7-36.
return	Returns to the preceding menu.
more 2/2	Returns to the menu on the previous page.

● Amplitude Condition for Next Peak Search

MARKER

ON → Peak → more 1/2

→ Peak Delta Y

To execute a next peak search, set up the amplitude condition for the target waveform with numeric keys and units keys. For example, entering "1div" corresponds to 1 division on the horizontal axis.
In case of the signal shown in Figure 7-15, it is necessary to treat each signal as a single amplitude (target for the next peak search) so that the next peak search can be executed to find the entire waveform amplitude data.

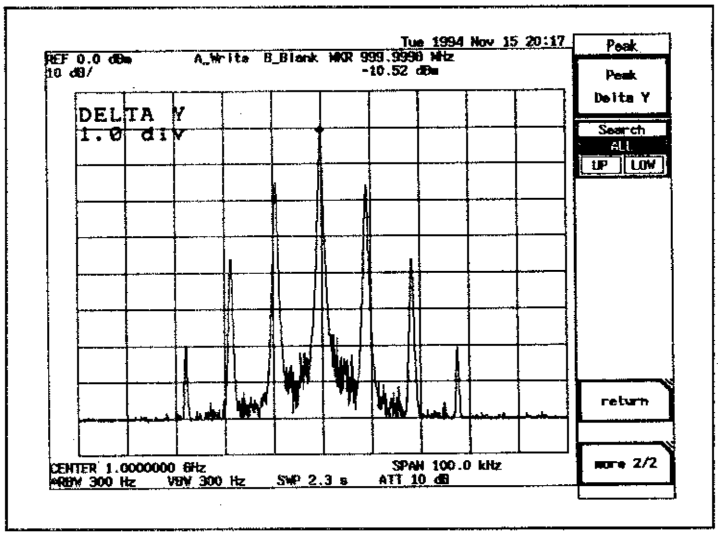


Figure 7-15 Next Peak Search Execution

Thus the target waveform for the next peak search as a ΔY can be set by using the amplitude value (div).

● △Y Setting

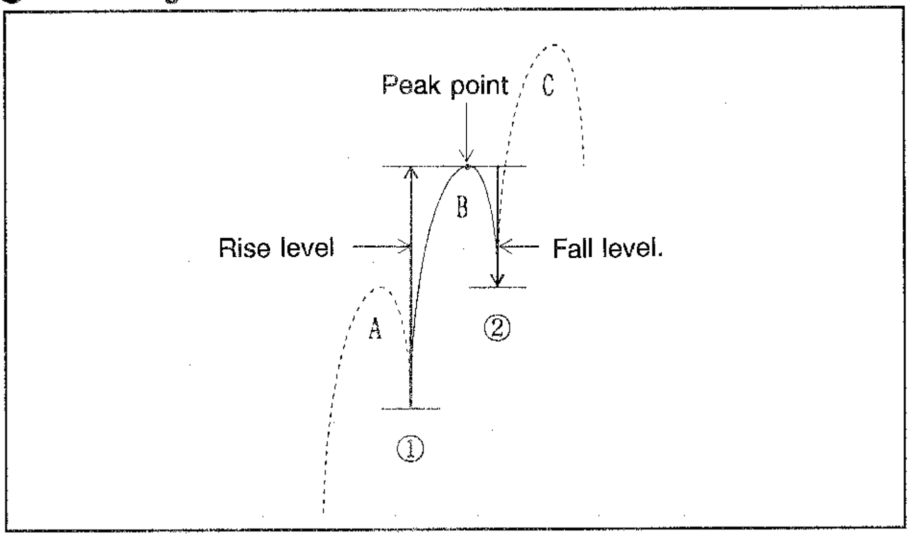
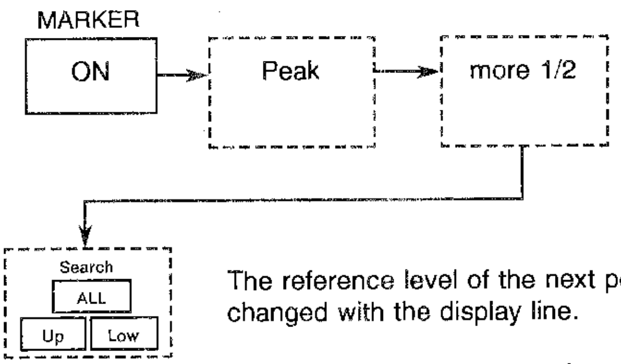


Figure 7-16 △Y Setting

The waveform B rises from the point ① and falls from the highest point (peak) to the point ②.
If the value for △Y is set even much lower than the rise/fall levels, the waveform B will be an object for the next peak search.
If the waveform amplitude data to be measured is much higher than the level of △Y which has been set, the waveform data is always an object for peak search.

● **Peak Search Level Changing**

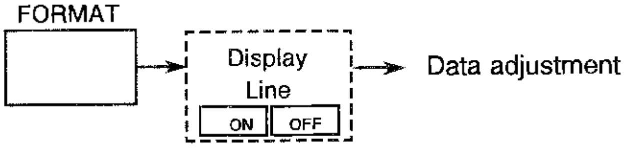


The reference level of the next peak search can be changed with the display line.

ALL : Executes a next peak search for the complete display. (Initial state)
Up : Executes a next peak search for levels above the display line. (See Figure 7-17.)
Low : Executes a next peak search for levels below the display line. (See Figure 7-18.)

To select Up or Low, adjust the level when the display line is ON.

<Display Line Setting>



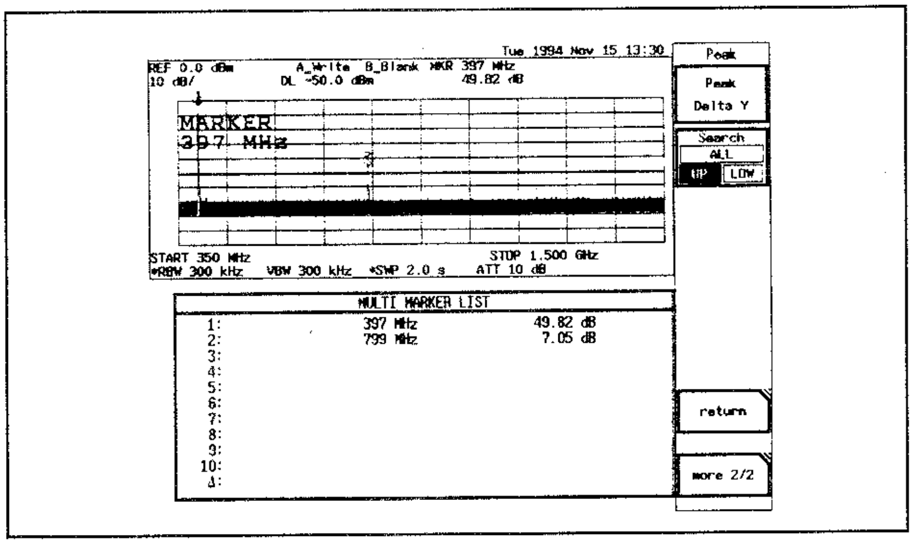


Figure 7-17 In the Case of Up Setting

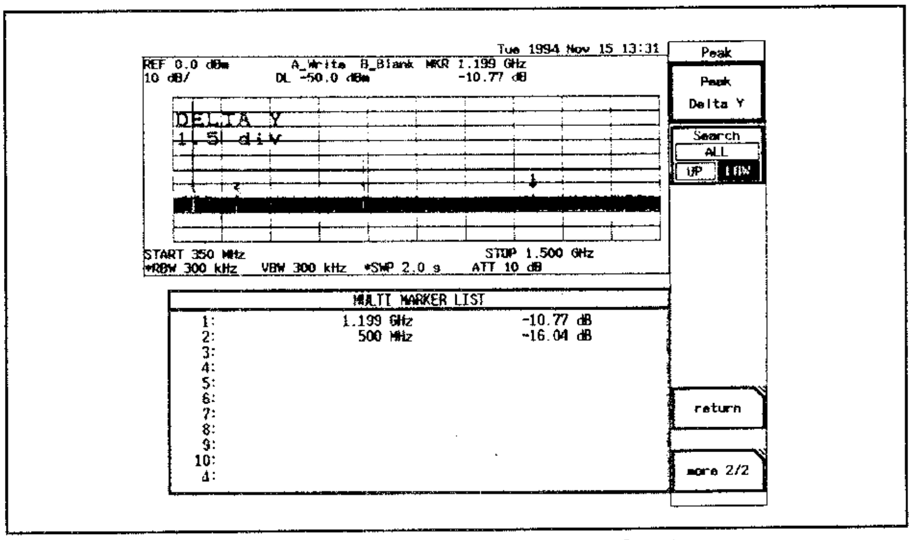


Figure 7-18 In the Case of Low Setting

■ Multi-marker mode

With multi-marker function, maximum 10 markers can be displayed. Thus, frequency and level values at multiple points can be measured at the same time.
One of the maximum 10 markers becomes active marker, which can be moved with ten-key, step key or data knob.

MARKER [ON] → [Multi MKR]

[Multi MKR Set] Displays the menu for selecting 1 to 10 markers.

[MKR NO X] Selects marker Nos. which are object of [MKR ON] and [MKR OFF] keys.
Each time this key is pressed, marker No. displayed in a field in the menu is incremented by 1 up to 10, and then returns to 1.

[MKR ON] Displays marker of the number selected with [MKR NO X] key. Each time this key is pressed, the marker No. displayed in [MKR NO X] is incremented.

[MKR OFF] Cancels displaying the marker of the number selected with [MKR NO X] key. Each time this key is pressed, the marker No. displayed in [MKR NO X] is decremented.

Key	Description
Active MKR	Changes over active marker among the markers displayed on the screen. Each time this key is pressed, the marker No. in the MKR NO menu changes in ascending order, showing that the marker is currently active.
Reset MKR	Deletes all other markers, displaying No. 1 marker only.
Reset MKR	Returns to the preceding menu.
MKR List ON / OFF	When turned ON, lists up frequency and level of all marker positions displayed on the screen.
Peak List Level	Displays 10 markers, and lists up their values in the order of waveform peak level.
Peak List Freq	Displays 10 markers, and lists up their values in the order of peak point frequency.
Multi MKR OFF	Deletes marker list and all displayed markers.

Marker → (Marker to)

Sets the current marker data (frequency, level, △, etc.) as the data for some other function.

MARKER ON → more 1/3 → Marker⇒

MKR⇒CF	Sets the center frequency to be the active marker frequency.
MKR⇒Ref	Sets the reference level to be the active marker level.
MKR⇒Harm	Sets the active marker frequency as the frequency of the basic wave in the Harmonic measurement function.
MKR⇒ CF Step	Sets the center frequency step size to be the active marker frequency.
Delta ⇒Span	Sets the frequency span to be the △ marker frequency.
return	Returns to the preceding menu.
more 1/2	Displays menu on the following page.
Delta⇒CF	Sets the center frequency to be the △ marker frequency.
Delta ⇒CF Step	Sets the center frequency step size to be the △ marker frequency.

MKR⇒ MKR Step	Sets the marker step size to be the active marker frequency.
Delta⇒ MKR Step	Sets the marker step size to be the △ marker frequency.
return	Returns to the preceding menu.
more 2/2	Returns to the menu on the previous page.

● **MKR⇒CF,MKR⇒REF Function**

⇒CF	Moves the marker to the maximum level of the waveform being displayed, and sets the center frequency to the frequency of the marker point.
⇒RL	Moves the marker to the maximum level of the waveform being displayed,and sets the reference level to the level of the marker point.

■ Other marker functions

MARKER
ON → more 1/3

Marker⇒

Fixed MKR [ON] [OFF]

Stores the frequency and level of displayed delta marker and fixes the marker at the absolute position on the screen. Therefore, even when center frequency or reference level is changed, the marker data is displayed based on the frequency and level at activating this function.

X dB Down

Displays the frequency or level difference between the reference marker and a marker displayed at X dB lower (or higher) position. X dB value can be set in the range from 0 to +/-dynamic range on the screen. Initial value is 3 dB.

X dB Down

Moves the marker to a position X dB lower than the reference marker.

X dB Left

Moves markers on the left of the reference marker to a position X dB lower than it.

X dB Right

Moves markers on the right of the reference marker to a position X dB lower than it.

Disp Mode [REL] [ABS.] [ABS.R]

Select marker display method for X dB Down operation.

REL : Display delta markers and the relative difference between two markers.

ABS.L : Display normal markers and the value of left side marker.

ABS.R: Display normal markers and the value of right side marker.

Count Down [ON][OFF]	When turned ON, continuously executes X dB Down. Obtains the peak of waveform for each sweep, and makes the marker down from this point. When turned OFF, cancels the function.
Next Peak Right	Returns to the preceding menu.
1/Delta MKR [ON][OFF]	Displays the inverse number of displayed delta marker. This function is useful for obtaining the modulation frequency when modulated wave is demodulated in zero span mode.
MKR Step [AUTO][MNL]	Sets the step frequency to move the marker with the step key. AUTO : Span becomes one tenth in the level. MNL : Sets the step frequency. Furthermore, it can be set as the time data in zero span.
Disp level [REL][ABS]	Switches the display of the marker level over relative and absolute. REL : Displays the level difference between the normal marker and the delta marker when the delta marker is turned ON. Displays the level difference between the display line and the marker when the display line is turned ON. ABS : Displays the value of the normal marker when the delta marker is turned ON. Displays the value of the marker independent of display line when the display lie in turned ON. ***CAUTION !*** ***When both the delta marker and the display line are turned ON, the delta marker takes priority.***
more 2/3	Displays menu on the following page.
Trace MKR Move	Switches the trace (A and B) in which the marker is available when both the trace A and B are displayed simultaneously. (However, it is only when the one screen is displayed.)
more 3/3	Returns to the menu on the previous page.

■ Marker OFF

MARKER
ON

MKR OFF

Erases all markers from the display. If there are any marker related functions active, set them OFF.

Functions which will be turned off are:

- Counter
- Sound
- Signal track
- Power Meas
- Noise/Hz
- Delta marker
- Continuous peak search
- Continuous dB down
- Multi marker list

4. Functions of SWEEP Mode

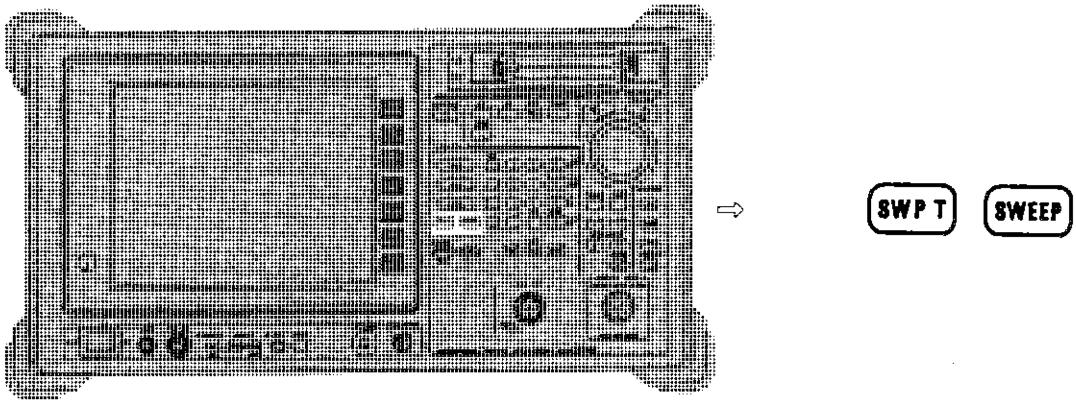


Figure 7-19 MARKER Section Key on the Front Panel

■ Sweep Key

● Explanation of Sweep Mode Menu

SWEEP → Sweep Mode

Gated Sweep	Displays the sub menu to execute gated sweep.
Window SWP ON/OFF	Performs a sweep in the measurement window.
return	Returns to the preceding menu.

■ Explanation of Gated Sweep Function

SWEEP → Sweep Mode → Gated Sweep

Gate POS WIDTH	Gate position and gate width are set up for the gated sweep. POS is selected then gate position (delay time) can be set up. WIDTH is selected then gate width (gate time) can be set up.
Gated SWP ON OFF	Selects ON and OFF of the gated sweep mode.
Gate Source EXT Gate in	Sets the gate signal source to the external signal which is input into "GATE IN" connector on the rear panel. (This mode is selected in the initial state.)
Gate Source EXT Trigger	External signal is set up for the gate signal source. External signal can be input to "EXT TRIG" connector on the rear panel.
Gate Source Slope + −	Selects the polarity of the external trigger signal.
return	Returns to the preceding menu.

● **Explanation of Trigger Menu**

SWEEP → Trigger Source	Displays a menu for trigger condition setup.
Free Run	Automatically repeats internal sweeping. (Initial set mode)
Line	Repeats sweep synchronized with AC supply frequency.
Video	Begins the sweeping depending on the level of the video signal.
Ext	Sweep is controlled with the external trigger. Trigger is executed when TTL level signal is applied to the EXT TRIG terminal on the rear panel and the signal falls from High to Low (-) or rises from Low to High (+).
Slope + -	Selects the polarity of an external trigger signal.
return	Returns to the preceding menu.

● **Explanation of Trigger Level Menu**

SWEEP → Trigger Level: Sets trigger level of the trigger source selected from Trigger Source menu. The level data set here is valid only for VIDEO trigger.

20 %	Sets trigger level at 20% position of the display.
Middle	Sets trigger level at 50% position of the display.
Y %	The active display of the current data appears. Set a trigger level to an arbitrary position with ten keys, step keys and a data knob.
return	Returns to the preceding menu.

"▸" is appeared on the scale of the left side of the screen to show the position of the trigger when the keys of [20%], [Middle], and [Y%] are pressed. The trigger level can be set by the data knob, the step key and the ten keys.

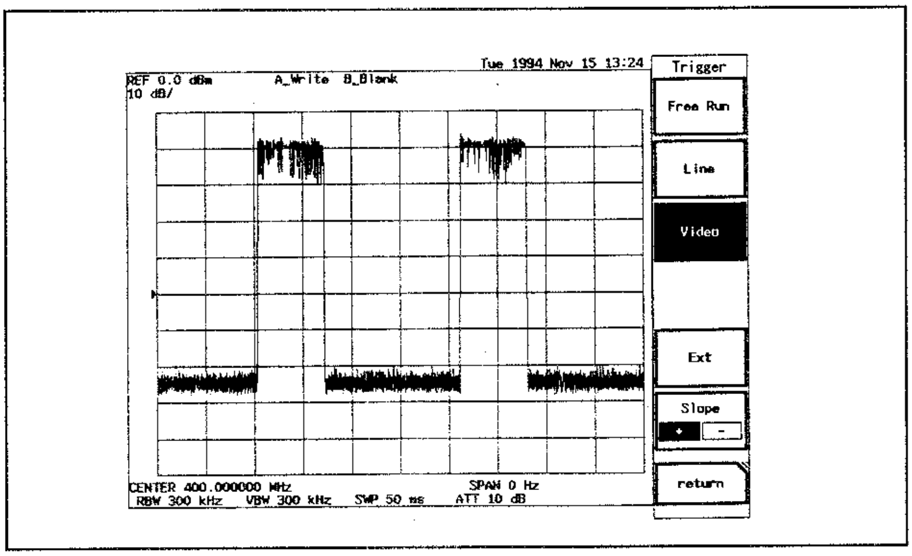


Figure 7-20 Trigger is made at the waveform being displayed

■ Explanation of START Lamp (LED)

In the case that "Trig Source" is in the Free Run setting, the START lump is turned on when the sweeping begins and it is turned off when the sweeping stops except in the case of Free Run setting.
During the gated sweeping, it is turned on during the gate is on and it is turned off when the sweeping is stopped.

Sweep Time

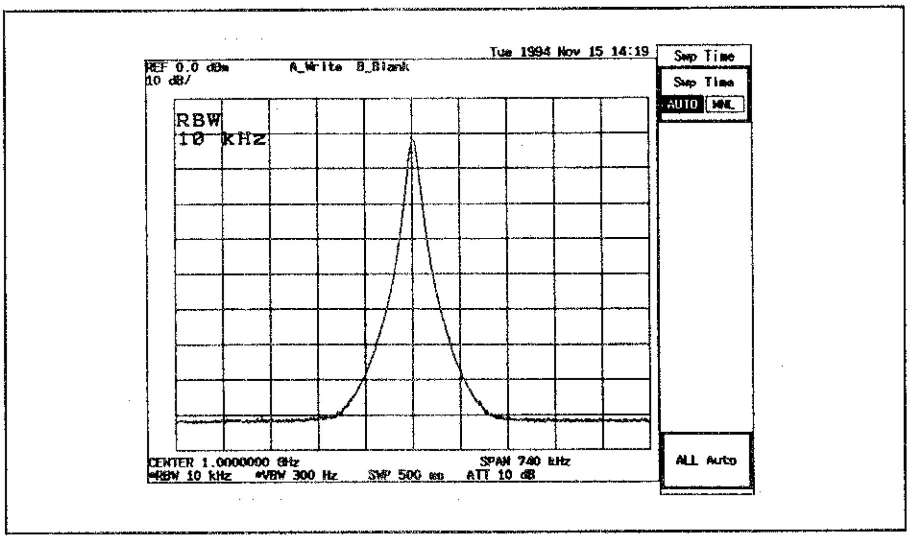


Figure 7-21 SWP = AUTO (500 ms)

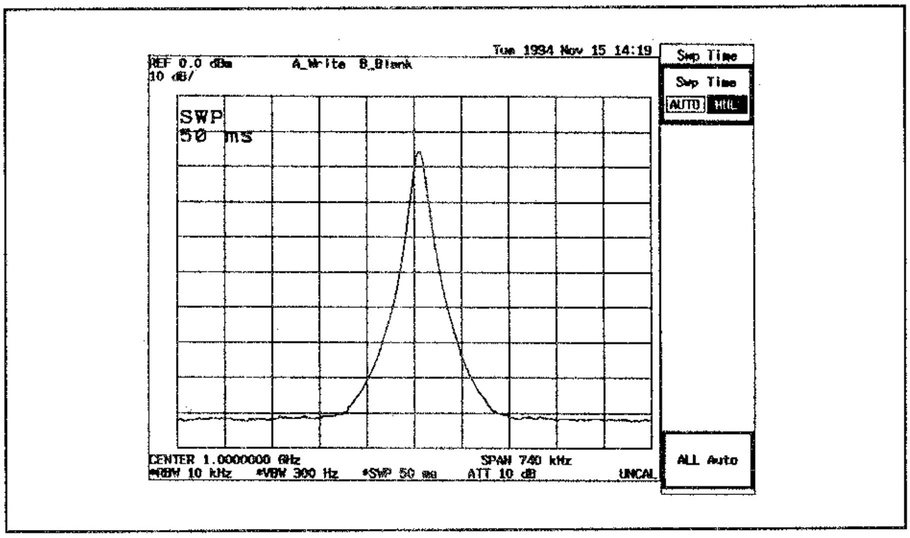


Figure 7-22 SWP = 50 ms

When sweep is too fast to display the signal (setting time of the filter), the level display has a error and the UNCAL message appears on the center of the screen. In this case, increase the sweep time.

● Sweep Time Setup Menu

SWP T

SWP Time [AUTO][MNL]

SWP can be set in the range of 30 ms to 1000 s. At AUTO initializing, sets the range automatically depending on for the frequency span, RBW, VBW, etc.
When the span is set to 0 Hz, SWP can be set in the range of 50 μs to 1000 s.
Relationship among frequency span, RBW, VBW and SWP in AUTO setting

$$\text{Frequency span}/\{\text{RBW} \times \text{Min (RBW, VBW)} \times 0.5\} = \text{SWP}$$

ALL Auto

Pressing this softkey sets all coupled functions (RBW, VBW and SWEEP TIME) to AUTO mode with a reference of the current span setting.

■ Sweep Mode Switching

SINGLE

Forcibly resets the sweeping even if it is in progress, and stops sweeping until the next pressing of this key. In the case the trigger condition is Free Run, sweep is performed once at the time of pressing this key. In the other case, sweep is performed once if the trigger condition is satisfied after pressing of this key.
If this key is used to execute MEASUREMENT function, the specified measurement is executed once.

START
REPEAT
STOP

Switches the sweep mode to Continuous or Stop.
When START is set, sweep is performed continuously in the trigger condition of Free Run. In the case of the other trigger condition, sweep is performed at every time the trigger condition is satisfied.
When STOP is set, sweeping is reset even if it is in progress.
If this key is used to execute MEASUREMENT function, the specified measurement is executed repeatedly.

5. Functions of MEASUREMENT Section

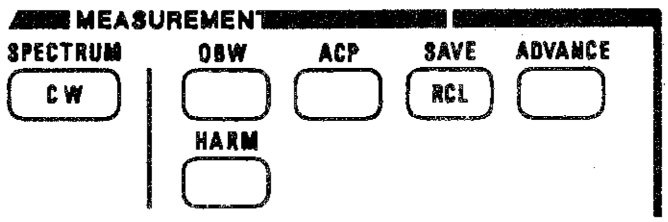


Figure 7-23 Panel Keys in MEASUREMENT Section

■ Explanation of OBW (Occupied Bandwidth) Key

Pressing [OBW] key enters OBW measurement mode, halting sweep.

This is the condition waiting for OBW measurement related parameters being input or measurement start command being input.

When currently set parameters need not be changed, press [REPEAT] or [SINGLE] key to start measurement.

When measurement has been started with [REPEAT] key, measurement is continued after the end of a measurement.

When measurement has been started with [SINGLE] key, operation stops after the end of a measurement.

OBW

Calculates the occupied bandwidth of the waveform displayed on the screen.
For the result, occupied bandwidth and carrier frequency (Fc) which is equal to the center frequency in the occupied bandwidth are displayed in the result display area on the screen.

OBW %

Sets the ratio to the total power in the occupied bandwidth.
Setting range is 10% to 99.8%, and initial value is 99%.

AVG Times ON OFF

Sets average times.
When turned ON, executes operation for measuring occupied bandwidth after executing trace averaging the set times.

Parameter Set Up

Displays the parameter select menu for the measurement of occupied bandwidth.

- **User**

  Specify to measure under the conditions set with Define→ User key.

- **Manual**

  Specify to measure with parameter setting other than the measurement parameters which are already specified or set with Define→ User key.
  When this measurement is selected, set necessary parameters before executing measurement.

Define→ User	Stores the current set condition and makes it the condition on selecting the User key.
return	Returns to the preceding menu.
Quit	Returns from OBW measurement mode to normal spectrum measurement mode.

■ Explanation of ACP (Adjacent Channels Leakage Power) Key

Pressing [ACP] key enters ACP measuring mode, halting sweep. When currently set parameters need not be changed, press [REPEAT] or [SINGLE] key to start measurement.

When measurement has been started with [REPEAT] key, measurement is continued after the end of a measurement.

When measurement has been started with [SINGLE] key, operation stops after the end of a measurement.

[ACP]

Calculates the total power from measured data displayed on the screen, and integrates power in specified bandwidth to obtain the ratio to the total power.
For out-of-spec measurement, 2 measuring methods are available: "Full mode" to measure based on the measured data which is displayed on a single screen and "Sepa mode" to measure based on the data obtained by dividing screen for specified channel and upper and lower channels.

Channel Spacing — Sets the distance between channels.

Specified Band WD — Sets specified bandwidth.

Parameter Set Up — Displays the parameters select menu for measuring the leak power from adjacent channels.

User

Specifies to measure under the conditions set with Define→ User key.

Manual

Specifies to measure under the condition set at present.
When this mode is selected, set necessary parameters before starting measurement.

Define→ User

Stores the current set condition and makes it the condition on selecting the User key.

return

Returns to the preceding menu.

Screen
Full Sepa

Selects the measuring mode for carrier and adjacent channels. In Full mode, the data in a single screen is fetched to execute calculation.
In Sepa mode, specified channel and upper and lower channels are independently swept and thus fetches the data for 3 screens to execute calculation.

CAUTION !
When you select the graph display at Sepa mode, be careful that Sepa mode automatically changes Full mode.

Graph

Graphs the leakage power of frequencies shown in the screen.

Operates the leakage power in the bandwidth specified by **Specified Bandwidth** and indicates the result as a trace B.

Graph ON OFF

When you select ON, the graph of the leakage power is displayed. The graph is displayed as the trace B after the end of a measurement and Δ marker automatically appears in the middle. Besides, all the current set maker moves onto the graph, we can easily see the leakage power of each frequency by the marker.

Multi MKR Set

By using the Multi Marker, we can see the leakage power of plural frequencies at the same time. Move the Multi Marker to the frequency point you want to measure. When the data of Multi Marker No.1 to No.6 are shown in the top right in the screen, we can see the leakage power of plural frequencies at the same time.

return

Returns the previous menu.

Quit

Returns from ACP measurement mode to normal spectrum measurement mode.

HARMONICS (higher harmonics) measuring function

Pressing HARM [ ] key enters higher harmonics measuring mode, halting sweep.
Entering higher harmonics measuring mode automatically sets start/stop frequency according to the parameters preset at selecting the mode.
When currently set parameters need not be changed, press [REPEAT] or [SINGLE] key to start measurement.

When measurement has been started with [REPEAT] key, measurement is continued after the end of a measurement.
When measurement has been started with [SINGLE] key, operation stops after the end of a measurement.

HARM [ ]

FUND Frequency	Sets the frequency of fundamental wave.
Harmonic Number	Sets which order higher harmonic to measure. The initial value is 3 and it is possible to be set from 2 to 10 with the ten keys.
Quit	Returns from HARM measurement mode to normal spectrum measurement mode.

■ Function of CW key

This key is used analyzing continuous wave signal by conventional spectrum analysis.

CW	Shifts to CW analysis mode.
Peak Search	Searches the maximum level of displayed signal and displays a marker on that point as well as the frequency and level at marker position.
Counter	Displays the menu for operating the counter at specified point.
Power Meas	Displays the menu for measuring power.
Spurious	Displays the menu for simple spurious measurement using the marker's peak list function.
more 1/2	Displays the menu on the following page.
Sound	Displays the menu of sound functions (AM/FM signal demodulation functions).
Noise/Hz	Displays the menu of noise measuring functions.
more 2/2	Displays the menu on the preceding page.

● Counter function

Counter function accurately measures the frequency of signal at a point where the marker is positioned. This function measures not the frequency of the marker itself but the frequency of the signal on which the marker is positioned. Therefore, it is unnecessary to move the marker on the peak of spectrum. However, displayed amplitude value corresponds to the maker position.

In normal maker mode, the frequency for marker position is displayed by calculating the marker position on frequency axis from center frequency. On the other hand, in counter mode, the frequency is directly measured with the frequency reference accuracy.

With software menu maximum 1 Hz resolution can be set. Increasing the resolution of the counter leads to longer gate time and longer sweep time.

CW → Counter

Resolution 1 kHz	Sets the resolution of frequency counter to 1 kHz.
Resolution 100 Hz	Sets the resolution of frequency counter to 100 Hz.
Resolution 10 Hz	Sets the resolution of frequency counter to 10 Hz.
Resolution 1 Hz	Sets the resolution of frequency counter to 1 Hz.
Counter ON OFF	When turned ON, starts frequency measurement with the counter.

MKR Move	Used to move the marker in order to change counting point. When pressed, the marker positioned on the currently frequency counting position can be moved with ten-key, step key or data knob.
return	Returns to the preceding menu.

CAUTION !

1. In the following cases, frequency counter mode may not display correct value.

- ***When span > 1 GHz***
- ***When the difference in noise level from marker point value is 25 dB or less***

2. Frequency counter mode cannot be used with SIGNAL TRACK mode.

● **Measurement of power**

CW → Power Meas	Selects power measurement mode. Power measurement is a function to obtain the power of a signal displayed on the screen and useful for measuring the power of wide band modulation wave. Execute "PBW" of "CAL" because RBW also must be corrected.
Channel Power	Measures power in a specified bandwidth in the window. (Executes the operation of the window span and RBW from the value of the average electric power in the window to have the sum total.)
Total Power	Measures the total power in the entire measuring span. (Executes the operation of the measurement span and RBW from the value of the average electric power to have the sum total.)
Average Power	Measures the power averaged over the entire measuring span. (Converts the data of all the displayed points (dBm) into the true number of the electric power dimension to have the average.)
Carrier Power	Measures peak power. (Moves the marker to the peak point and has the electric power.)
return	Returns to the preceding menu.

● **Spurious measurement**

CW → Spurious	Selects spurious measurement mode (display of peak list).
Peak List Freq	Lists up peak values from high to low frequency in order.

Peak List Level	Lists up peak levels from high to low levels in order.
List OFF	Cancels displaying the peak list.
return	Returns to the preceding menu.

● Sound function

CW → more 1/2 → Sound

Sound AM FM	Toggles between AM and FM. AM: Demodulates AM wave into audible sound via internal speaker. FM: Demodulates FM wave into audible sound via internal speaker.
Volume	Changes sound volume in 8 steps (1 to 8) with data knob, step key or ten-key.
MKR Pause Time	Sets pause time, which is displayed on the screen. Stops sweeping at the marker point for specified PAUSE time. PAUSE time can be set in the range from 100 ms to 1000 s with data knob, step key or ten-key.
Squelch ON OFF	When turned ON, an arrow mark (▸) appears at right on the scale in the screen, disabling the demodulation of the signal which is lower in level than the SQUELCH level.
Sound OFF	Cancels sound mode and returns to the preceding menu.

● **Noise/Hz measurement**

CW → more 1/2 → Noise/Hz

dBm/Hz	Sets REF LEVEL to dBm to measure noise level.
dBμV$\sqrt{\text{Hz}}$	Sets REF LEVEL to dBμV to measure noise level.
dBc/Hz	Displays a fixed delta marker at active marker position, entering dBc/Hz measuring mode.
Noise/Hz OFF	Cancels noise measuring function to display the menu on the preceding page.

6. Save Function

■ Save function menu

SHIFT + SAVE (RCL)

Save Register	Displays the sub menu to save in the built-in backup memory.
Clear Register	Displays the sub menu to delete the data saved in the built-in backup memory.
Save File	Displays the submenu for saving data in a memory card or built-in backup memory.
Clear File	Displays the submenu for deleting files in a memory card or built-in backup memory.

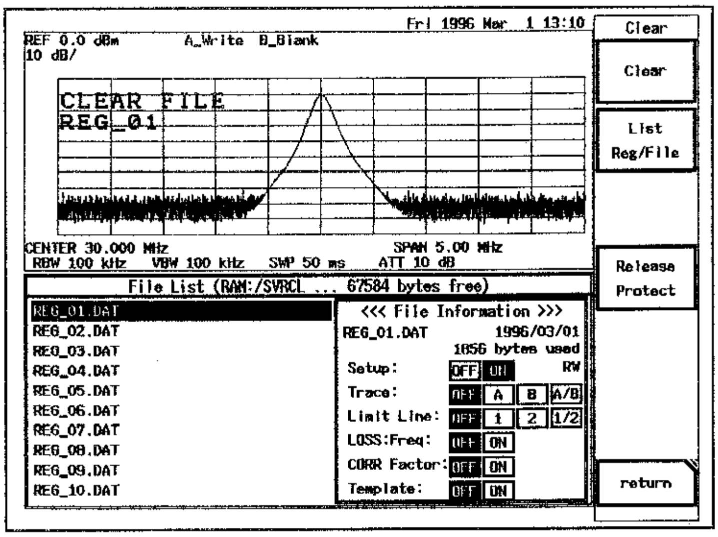


Figure 7-24 Displayed drive list

List Reg/File

Displays the list of the files (or the registers).
Displays the file name, title, size, date, write protection and the sort of the saved data.
Selects a file (or register) with the step key or with the data knob referring to this list.

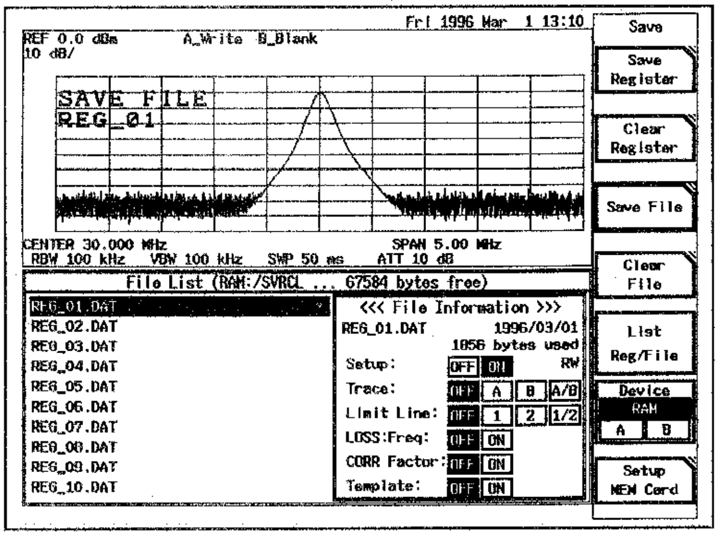


Figure 7-25 Displayed drive list

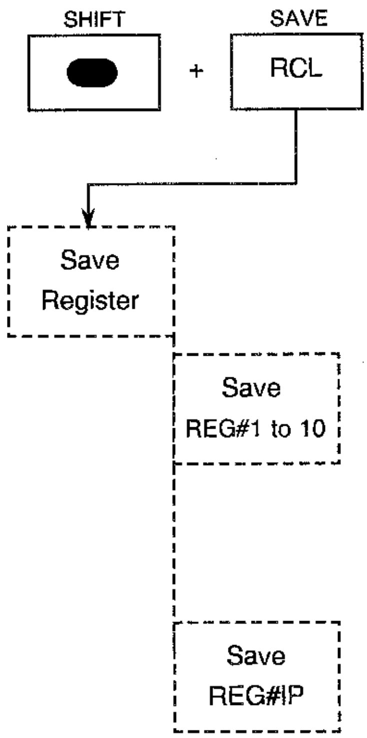
Device
RAM
A B

Selects a drive for saving data (built-in backup memory or memory card (A or B)).

Setup MEM Card

Displays the submenu for formatting a memory card or other operations.

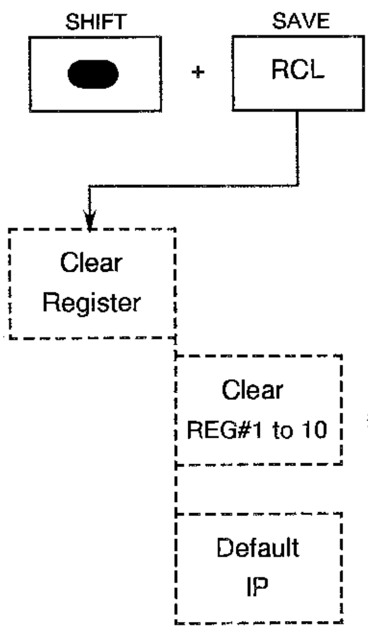
● **Save Register menu**



Save REG#1 to 10: Saves the current set conditions and other data in a register (#1 to #10) allocated in the software menu. The object items of saving are automatically determined according to the condition at saving. (The register is one kind of the files allocated in the built-in backup memory.)

Save REG#IP: In order to change the content of IP (instrument preset) to the currently set conditions, saves data in IP register.

● **Clear Register menu**



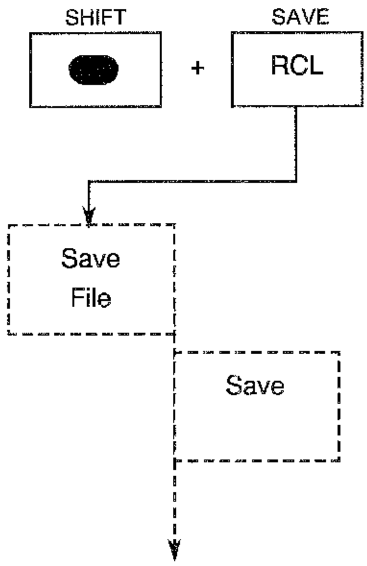
Clear REG#1 to 10: Deletes the contents in the register (#1 to #10) allocated in the software menu.

Default IP: Initializes the contents of IP (Instrument Preset) to the set condition at shipment.

● **Save File menu**

CAUTION !

Each software key in Save File is available on the files in the device selected with "Device RAM/A/B" key.
However, in the case that RAM (the built-in backup memory) is selected, the file name cannot be changed by Rename key.



On pressing this key, the selected items of saving are saved as a file in a memory card.

List Reg/File

Displays the list of the files (or the registers).
Displays the file name, title, size, date, write protection and the sort of the saved data.
Selects a file (or register) with the step key or with the data knob referring to this list.

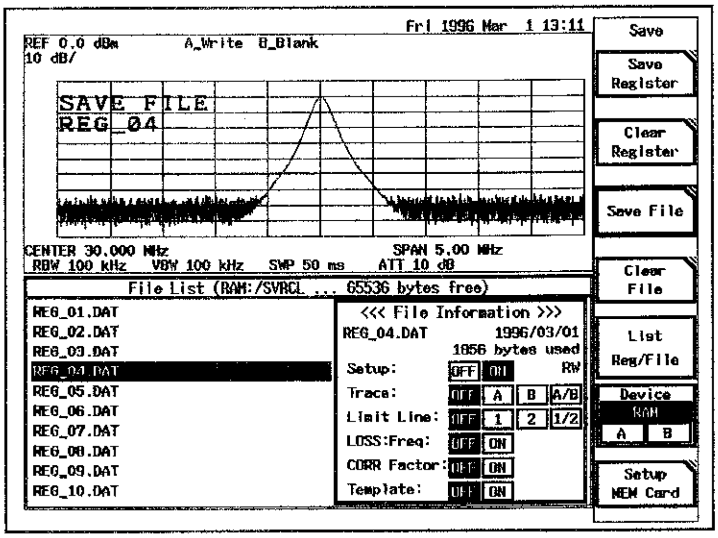


Figure 7-26 Displayed drive list

Enter Title

Sets a heading (title) for the saved data so as to be distinguished from other data.

Write Protect

Enable/disable write protection for specified file.

Rename

Changes the specified file name.
On pressing this key, the keyboard dialog box for input the file names is displayed on the center of the monitor. So, select the characters with the data knob and the step key and press the knob to input the characters.

Select Item	Selects which set conditions and measured data to save with Dialog Box.

This function is used to arbitrarily set conditions, although in general these are automatically selected according to set conditions. To avoid duplication of data, this function is used to save only set conditions. For data, this function is used when data is saved only once and, after that, no longer saved.
The following conditions can be selected:

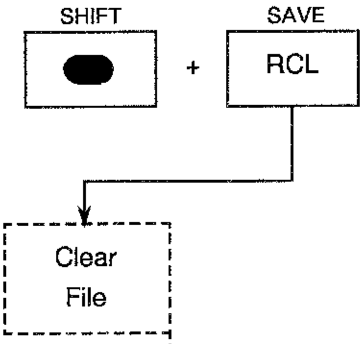
- Set conditions
- Waveform data A or B (view trace)
- Correction data (normalize trace)
- User defined limit lines 1 and 2 (limit line ON)
- User defined correction data (Conv.LOSS vs Freq.ON)
- Correction factor data
- Transient user definition template.※

※: Not available for R3272.

● **Clear File menu**

CAUTION !

Each software key in Clear File is available on the files in the device selected with "Device RAM/A/B" key.
However, in the case that RAM (the built-in backup memory) is selected, the operation by the "Clear" key is not deleting the files but deleting the data in the files.



Clear	Pressing this key deletes a file specified with data knob.
List Reg/File	Displays the list of the files (or the registers). Displays the file name, title, size, date, write protection and the sort of the saved data. Selects a file (or register) with the step key or with the data knob referring to this list.
Release Protect	When specified file is write protected, pressing this key cancels the write protection.

● **Select Item menu**

SHIFT + SAVE RCL → Save Register

Select Item

On pressing this key, the following dialog box is displayed and the items of saving can be selected. Each item is determined by pressing the data knob after selecting ON and OFF by turning the data knob. And each set items are changed with the step key.

Setup Save Item					
Data Format	:	BIN			
Setup	:	OFF	ON		
Trace	:	OFF	A	B	A/B
Limit Line	:	OFF	1	2	1/2
LOSS:Freq	:	OFF	ON		
CORR Factor	:	OFF	ON		
Template	:	OFF	ON		

Default

In general, selects which item to save according to set conditions. The select conditions are as follows:

- Set conditions : ON
- Waveform data A and B
  : view trace side
- User defined limit lines 1 and 2
  : limit line ON
- Conv.LOSS vs Freq.ON user defined correction data : LOSS vs Freq.ON
- Correction factor data
  : Correction ON
- Transient user definition template.
  : OFF ※

※: Not available for R3272.

return

Returns to the preceding menu.

7. Recall Function

■ Recall function menu

SAVE

RCL

Recall Register — Displays the sub menu to recall in the built-in back up memory.

Recall File — Displays the sub menu for recalling data from a file in a memory card.

List Reg/File — Displays the list of the files (or the registers).
Displays the file name, title, size, date, write protection and the sort of the saved data.
Selects a file (or register) with the step key or with the data knob referring to this list.

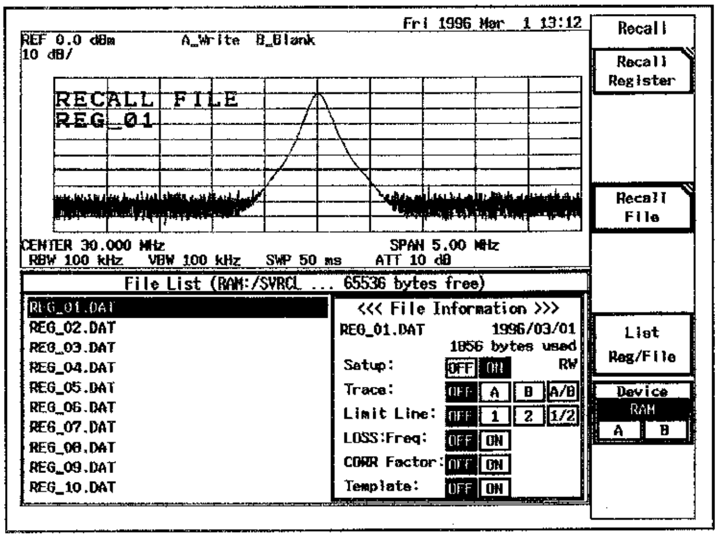


Figure 7-27 Displayed drive list

Device: RAM / A / B	Selects the embedded backup memory or the memory card (A/B) as a drive to save.

● **Recall Register menu**

SAVE

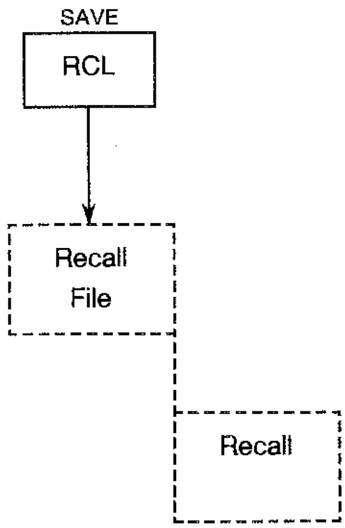
RCL

Recall Register

Recall REG#1 to 10	Recalls the current set conditions and other data from the register (#1 to #10) allocated in the software menu.
Recall on POWER	Recalls the setting condition made just after switching on the instrument.

● **Recall File menu**

CAUTION !
Recall File is available on the files in the device selected with "Device RAM/A/B" key.



Pressing this key after selecting a file from the file list with data knob recalls set conditions and measured data from the specified file.

8. Calibration Function

■ Recall function menu

SHIFT + 7

Cal All	Executes calibration items described below. After the end of calibration, enters error correct mode.
Total Gain	Measures absolute error under the condition of 300 kHz resolution bandwidth and -10 dBm, 1 dB/DIV calibration signal output.
CAL Each Item	Each item can be calibrated separately.

Input Att	Measures the input attenuator switching error and executes calibration.
IF Step AMP	Measures IF STEP AMP switching error and executes calibration.
RBW Switching	Measures IF filter resolution switching error and executes calibration.
Log Linearity	Measures the linearity of the axis of ordinate in the range from 10 to 0.5 dB/DIV in LOG scale on the screen and executes calibration.
Amplitude MAG	Measures switching error in the range from 10 to 0.5 dB/DIV in LOG scale and executes calibration.
PBW	Measures PBW (noise power bandwidth) in the range of 300 Hz to 5 MHz resolution bandwidth to correct the noise level (NOISE/Hz) measured with the marker.

return — Displays the menu on the preceding page.

Freq Corr ON OFF — This instrument stores the frequency characteristic measured at shipment. Turning this function ON corrects frequency characteristic.

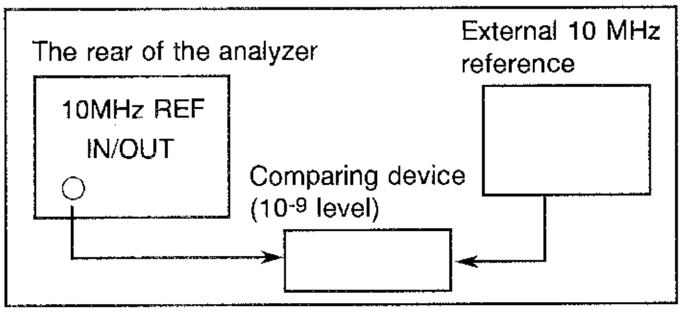
Cal Corr ON OFF — Selects whether or not to use the calibration factor obtained by calibration.

Cal Sig Level — Sets the level of calibration signal output in the range from -10 to -30 dBm in 0.5 dB step with ten-key, data knob or step key.

CAL 10MHz REF — The calibration of the internal reference frequency can be carried out.
Ten key, step key,and data knob can be used for the data setup.
The range of setup data is -100 to 100.

REFERENCE ➜
How to calibrate the internal frequency reference source

To calibrate the internal frequency reference source, connect the frequency comparing device with the analyzer and the external 10 MHz reference signal source as follows.



Press CAL 10MHz REF ***and change the data from -100 to 100 until the internal reference signal become equal to the external 10 MHz reference signal.***

Store	Uses to store the setup data. Dialogue box is displayed by pressing this key then select "Confirm" by rotating and pressing the data knob. If it is not necessary to store the setup data then select "Cancel" by rotating and pressing the data knob.
return	The menu of the previous page is displayed.

CAUTION !

Sometimes there is a switching noise in the equipment on executing the calibration; it is caused by the switching of the internal attenuator.

Use the attached MC-61 as the input cable.

9. System Functions

LCL

SYS

Ref 10M [INT] [EXT]

Selects whether internal (INT) or external (EXT) reference frequency (10 MHz) to use.
When EXT is selected, external signal input through the REF IN/OUT terminal on the rear panel is used. (Frequency error and level of input signal must be 5×10^{-6} or less and in the range from -5 to +5 dBm, respectively.)
When external reference frequency is selected, the characters of "EXT" is displayed at the left side on the screen.

Date/Time

Sets date and time. Select an item with arrow key and change data with ten-key or data knob.
Each data is set by pressing the knob or ENTER key after changing the data. The date and the time become available immediately after the changing.

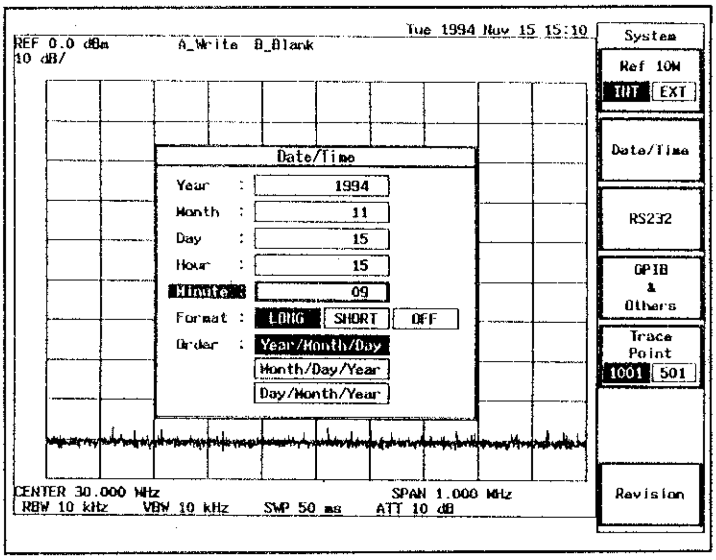


Figure 7-28 Setting the data and time

RS232

Sets conditions for RS-232.

GPIB & Others	Sets address for GPIB. Addresses from 0 to 30 are available. Moreover, the target device can be set at the time of pressing COPY key. ***CAUTION !*** ***If the power is turned off after the setting is changed but the dialog Box is being displayed, the setting is ignored.***
Trace Point 1001 501	Selects the number of points for trace data. Initial value is 1001. **Note:** ***Sometimes the current trace data is displayed temporally by the number of its point when the number point is switched.***
Revision	Displays the software revision of this device.

10. Window Function

WINDOW

Menu	Submenu	Description
Measuring Window		Sets window display conditions.
	Window ON OFF	Turns ON/OFF window display. ***Note*** ***The window of the upper screen cannot be turned OFF in double screens display mode.***
	POS / WIDTH	Selecting POS makes it possible to change the position of window. Selecting WIDTH makes it possible to change the width of window.
	Couple to Marker ON OFF	Specifies a range for peak search and dB down with marker. ON uses the range in a window, while OFF uses the range of set span.
	return	Returns to the preceding menu.
Zoom		Selects the spectrum display which uses upper and lower two screens. In the lower half screen, a part of the upper screen is enlarged.
	POS / WIDTH	"POS" varies the window position and "WIDTH" varies the window width.
	Reset	Cancels double screen display (ZOOM) mode.
	return	Returns to the preceding menu.

F/T

Upper and lower two screen display mode. Upper half screen displays spectrum, while lower half screen displays time based waveform.
The window at this time is displayed with the vertical lines of the window width = 0Hz.

POS
WIDTH

Selecting POS makes it possible to change the position of window. Selecting WIDTH makes it possible to change the width of window. (The screen becomes the same as in ZOOM by changing the width of the window.)

Reset

Cancels double screen display (F/T) mode.

return

Returns to the preceding menu.

Screen Reset

Turns OFF screen display and returns from double screen display mode to ordinary single screen display mode.

A B

Executes the selection of the active screen in double screen display mode.

SCREEN

On pressing A, the upper screen becomes active.

On pressing B, the lower screen becomes active.

Note
A frame is displayed around the scale on the active screen.

CHAPTER 8

REMOTE CONTROL INTERFACE

This chapter explains external control via GPIB or RS-232 interface and GPIB command codes.

CONTENTS

1. Introduction 8-2
2. GPIB BUS Functions 8-5
3. Command Syntax 8-10
4. Status Bytes 8-13
5. List of GPIB Command Codes 8-22
6. Sample programs 8-38
7. RS-232 Remote Control Function 8-59

1. Introduction

This instrument is equipped with a GPIB (General-Purpose Interface Bus) as standard, which complies with IEEE standards 488.1-1978 and can be remotely controlled by means of an external controller. The analyzer also has a built-in control function, enabling easy configuration of small GPIB systems (Option).

■ GPIB

The GPIB is a high-performance interface bus used to connect the measuring instruments to the computer.
The operations of the GPIB are defined by IEEE standard 488.1-1978. Since the GPIB has a bus-configured interface, it can specify a device by assigning a specific address to each device. Up to 15 devices can be connected in parallel to a single bus. GPIB devices have one or more of the following functions:

● Talker
The talker is a device which is specified to send data to the bus. Only one active talker can exist on the GPIB bus.

● Listener
The listener is a device which is specified to receive data from the bus. Multiple active listeners can exist on the GPIB bus.

● Controller
The controller is a device which specifies the talker and listener. Only one active controller can operate on the GPIB bus. Controllers which control IFC and REN messages are called "system controllers".

The GPIB bus can have only one system controller on it. If there are multiple controllers on the bus, the system controller becomes the active controller, while other devices which have a control function operate as addressable devices when the system is started up.

The TCT (Take Control) interface message is used to set a controller other than the system controller as the active controller. After setting, the system controller will become the non-active controller.

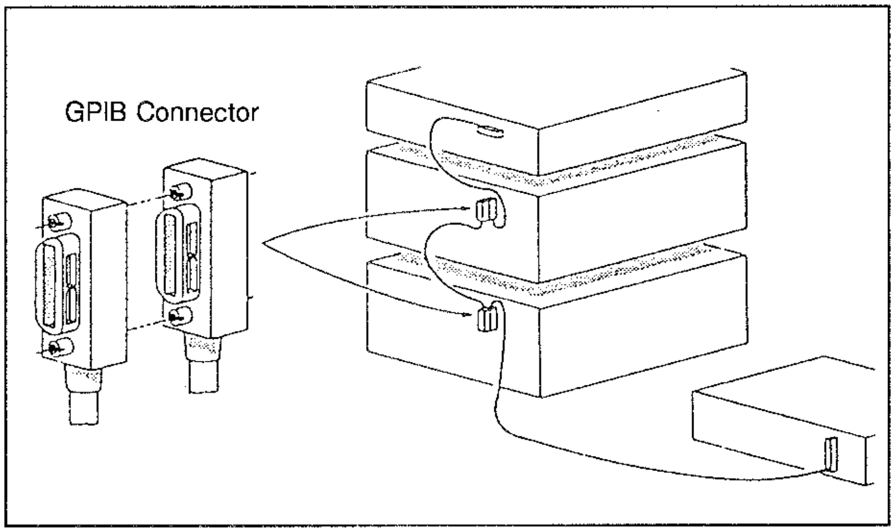
The controller controls the entire system by sending interface messages or device messages to each measuring instrument. The functions of the messages are:

- Interface message: Control of the GPIB bus
- Device message: Control of the measuring instrument

GPIB Setup

Connecting GPIB

The following shows the standard GPIB connector. Secure the GPIB connector with the two screws to prevent it from coming loose during use.



The following precautions should be observed when using the GPIB interface:

- The total GPIB cable length in a single bus system should not exceed n x 2 meters, where n = the number of devices to be connected, including the GPIB controller. In no case should the cable length exceed 20 meters.
- Up to 15 devices can be connected to a single bus system.
- There are no restrictions concerning the method of connection between cables. However, no more than three GPIB connectors should be connected to a single device, since the use of excessive force could damage the connector mounting.

For example, the total cable length in a system with 5 devices should be 10 meters or less (2 meters x 5 devices = 10 meters).The total cable length can be distributed freely within the range of the maximum allowed cable length. However, if more than 10 devices are to be connected, some of them should be connected using cables of less than 2 meters so that the total cable length does not exceed 20 meters.

- **Setting of GPIB address**

1. **Press** [LCL / SYS] **and** [GPIB & Others] **keys.**
2. **With ten-key, input GPIB address for this instrument.**
3. **Press** [Hz] **key to enter.**

2. GPIB BUS Functions

■ GPIB Interface Functions

Code	Description
SH1	Source handshake function
AH1	Acceptor handshake function
T6	Basic talker function, serial polling function, listener-specified talker cancel function
TE0	Without extended talker function
L4	Basic listener function, talker-specified listener cancel function
LE0	Without extended listener function
SR1	Service request function
RL1	Remote function, local function, local lockout function
PP0	Without parallel polling function
DC1	Device clear function
DT0	Without device trigger function
C1	System controller function
C2	IFC transmission, controller in charge function
C3	REN transmission function
C4	SRQ response function
C12	Transmission of interface messages, control transfer function
E1	Using open-collector bus driver

Note : ***C1, C2, C3, C4 and C12 function only when the options are packaged.***
C0 (no system controller function) is in standard instrument without controller option.

Controller Functions

This instrument has a system controller mode and an addressable mode. The features of each mode are as follows:

	System Controller Mode (option 15)	Addressable Mode
At startup	Active controller	Non-active controller
IFC	Controllable	Not controllable
REN	Controllable	Not controllable

To be active in the addressable mode, R3272 must have received the TCT interface message.

Only one system controller is allowed on the GPIB bus. When a system connected through the GPIB bus is started up, the system controller becomes the active controller. Only one active controller at a time is allowed on the GPIB bus. The controller controls the devices on the bus by sending interface messages and receiving service requests (SQR). Note that the IFC and REN interface messages are sent by the system controller only.

Interface messages are used to send indications of talker and listener, serial poll, device clear, trigger, local, and the other information to the measuring instrument. Service requests are used to receive interruptions from the instrument.

The active controller can transfer control to any non-active controller. After specifying the talker as the device to which control is to be transferred, the active controller sends a TCT interface message to transfer control to the talker. This operation is called "pass control".

When the system controller sends an IFC interface message, control is returned from the active controller to the system controller.

Responses to Interface Messages

The responses of this instrument to interface messages are defined by IEEE standards 488.1-1978 and are described in this section.
For information on how to send interface messages to this instrument, refer to the instruction manual of the controller to be used.

● Interface Clear (IFC)

The IFC message is transmitted directly to this instrument through a signal line. The message allows this instrument to stop the operation of the GPIB bus. Although all input/output operation is stopped, the input/output buffer is not cleared. Note that the DCL is used to clear the buffer. If this instrument is specified as an active controller at that time, control of the GPIB bus will be removed from this instrument and transferred to the system controller.

● Remote Enable (REN)

The REN message is transmitted directly to this instrument through a signal line. If this instrument is specified as a listener when the message is true, this instrument is in the remote mode. This instrument remains in the remote mode until the GTL message is received, or the REN becomes false, or the LOCAL key is pressed.
When this instrument is in the local mode, it ignores all the received data. When this instrument is in the remote mode, it ignores all key inputting other than LOCAL key inputting. When this instrument is in the LOCAL LOCKOUT mode (LLO; see **Page 8-8**), it ignores all key inputting.

● Serial Polling Enable (SPE)

When this instrument receives a message from external devices, it is in the serial polling mode. If this instrument is specified as a talker in this mode, it sends status bytes instead of normal messages. This instrument remains in the serial polling mode until the SPD (Serial Polling Disable) message or the IFC message is received.
When this instrument sends an SRQ (Service Request) message to the controller, bit 6 (RQS bit) of the response data is set to 1 (true). When this instrument has finished sending this message, the RQS bit reverts to 0 (false). The SRQ (Service Request) message is sent directly through a signal line.

● Device Clear (DCL)

When this instrument receives the DCL message, it performs the following:

- Clearing of the input and output buffers
- Resetting of syntax analysis, execution control and response data generation
- Cancellation of all commands that prevent the remote command from being executed next
- Cancellation of commands that are paused to wait for other parameters

It does not perform the following:

- Changing of data set or stored in this instrument
- Interruption of the front panel operation
- Modification or interruption of instrument operations being executed
- Changing of status bytes other than MAV. (MAV becomes 0 when the output buffer is cleared.)

● **Selected Device Clear (SDC)**

The SDC message operates in the same manner as the DCL message. However, it is executed only when this instrument is as a listener. In other cases, it is ignored.

● **Go To Local (GTL)**

The GTL message places this instrument in the local mode. In the local mode, all the operations on the front panel are available.

● **Local Lockout (LLO)**

The LLO message places this instrument in the local lockout mode. If this instrument is set to the remote mode in this mode, all the operations on the front panel will be inhibited. (Note that in the normal remote mode, front panel operations can be performed using the LOCAL key.)
The following three methods can be used to set this instrument to the local mode from the local lockout mode:

- Sending a GTL message to this instrument
- Setting the REN message to false (In this case, the local lockout mode will be canceled.)
- Switching on this instrument power again

● **Take Control (TCT)**

If this instrument receives the TCT message when it is specified as a talker, it becomes the active controller through "pass control". On receiving the IFC message, this instrument returns to the addressable mode.

Message Exchange Protocol

This instrument receives program messages from controllers or other devices through the GPIB bus and generates response data. The program messages include commands, queries (commands used to query response data) and data. The procedure used to exchange these commands, queries and data is explained in this section.

● GPIB Buffers

This instrument is equipped with the following three buffers:

○ Input buffer

The input buffer is used to store data temporarily for command analysis (It has the length of 1024byte but the input above it is ignored.)
Either of the following two methods can be used to clear the input buffer:

- Switching on this instrument power
- Execution of the DCL or the SDC

○ Output buffer

The output buffer is used to store data which are to be read from the controller (1024 bytes).
Either of the following two methods can be used to clear the output buffer:

- Switching on this instrument power
- Execution of the DCL or the SDC

● Message exchange

The following are the most important events when another controller or device receives messages from this instrument:

- Response data are generated when a query is received.

○ Purser

The purser receives command messages in the order of reception from the input buffer, analyzes the syntax and determines what the received command is to execute.

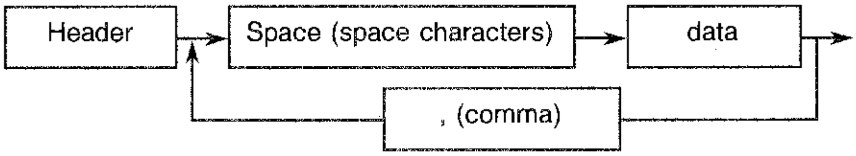
○ Generating response data

When the purser executes a query, this instrument generates data in the output buffer in response to it (that is, to output data a query must be sent immediately before the data).

3. Command Syntax

Command Syntax

The command program for R3272 command mode is defined in the following format:



Header

Two types of header are available: common command header explained below and simple header.
Common command header has an asterisk (*) at the top of mnemonic.
Simple header is a functionally independent command which has no hierarchical structure.

Attaching "?" in front and in the rear of a header makes a query command.

Space (space character)

One space or more is required in this field. (A space may be omitted.)

Data

When the command requires multiple data, the data should be separated with commas. A space may be inserted before or after the each comma.
For details of data types, refer to "Data Formats".

For details of data type, see the paragraph for data format (on page 8-11).

Writing multiple commands

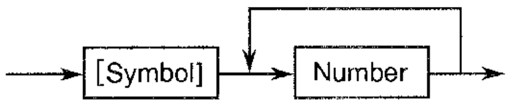
The instrument is possible to write multiple commands by separating them with semicolons.

■ Data Formats

The instrument uses the data formats for data input/output shown in this section.

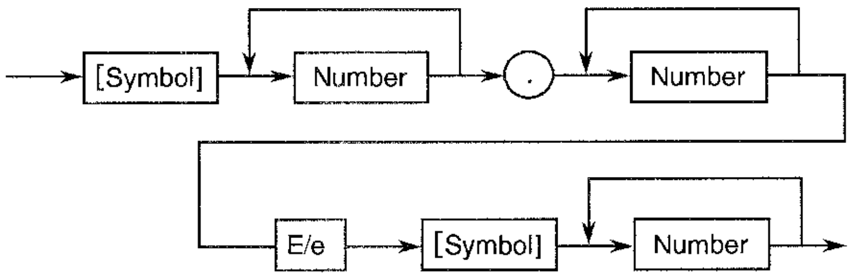
● Numeric data
There are three numeric data formats, any of which can be used for numeric data input.
Some commands add the units to the data at data inputting. For information on units, refer to next page.
The following shows the format of the character data.

- Integer type: NR1 format



- Fixed-point type: NR2 format

- Floating-point type: NR3 format



Note
Symbols at the beginning may be omitted.

● **Units**

The table below lists the units which can be used.

Suffixes	Unit	Commands with which Usable
GZ	10^{9}	Frequency
MZ	10^{6}	Frequency
KZ	10^{3}	Frequency
HZ	10^{0}	Frequency
MV	10^{-3}	Voltage
MW	10^{-3}	Power
DB	10^{0}	dB
MA	10^{-3}	Current
SC	10^{0}	Second
MS	10^{-3}	Second
US	10^{-6}	Second

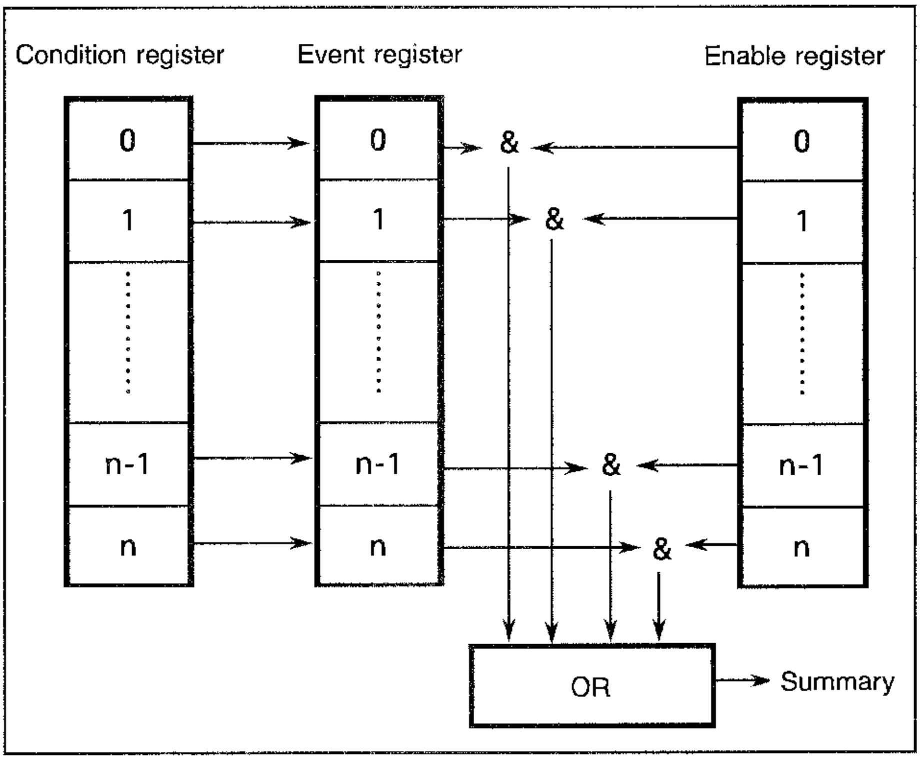
4. Status Bytes

The instrument has a hierarchical status register structure in compliance with IEEE standard 488.2-1987, which is used to send various device status information to the controller. This chapter explains the operational models of the status byte and event assignments.

■ Status Register

● Status Register Structure

The instrument employs the status register model defined by IEEE standard 488.2-1987 and consists of a condition register, an event register and an enable register.



○ **Condition register**

The condition register continuously monitors the status of devices, that is, retains the latest status of devices. However, this register is retained as the internal information, so, no data can be written or read into this register.

○ **Event register**

The event register latches and retains the status information from the condition register. (In some cases, it retains status changes.)
Once the register is set, the condition is maintained until a query command reads out the information or the register is reset by means of the *CLS command. No data can be written into this register.

○ **Enable register**

The enable register specifies which bit in the event register is to be used as the valid status to generate a summary. The enable register is ANDed with the event register. The OR of the result of the AND operation is generated as a summary. The summary is written into the following status registers. Any data can be written into these registers.

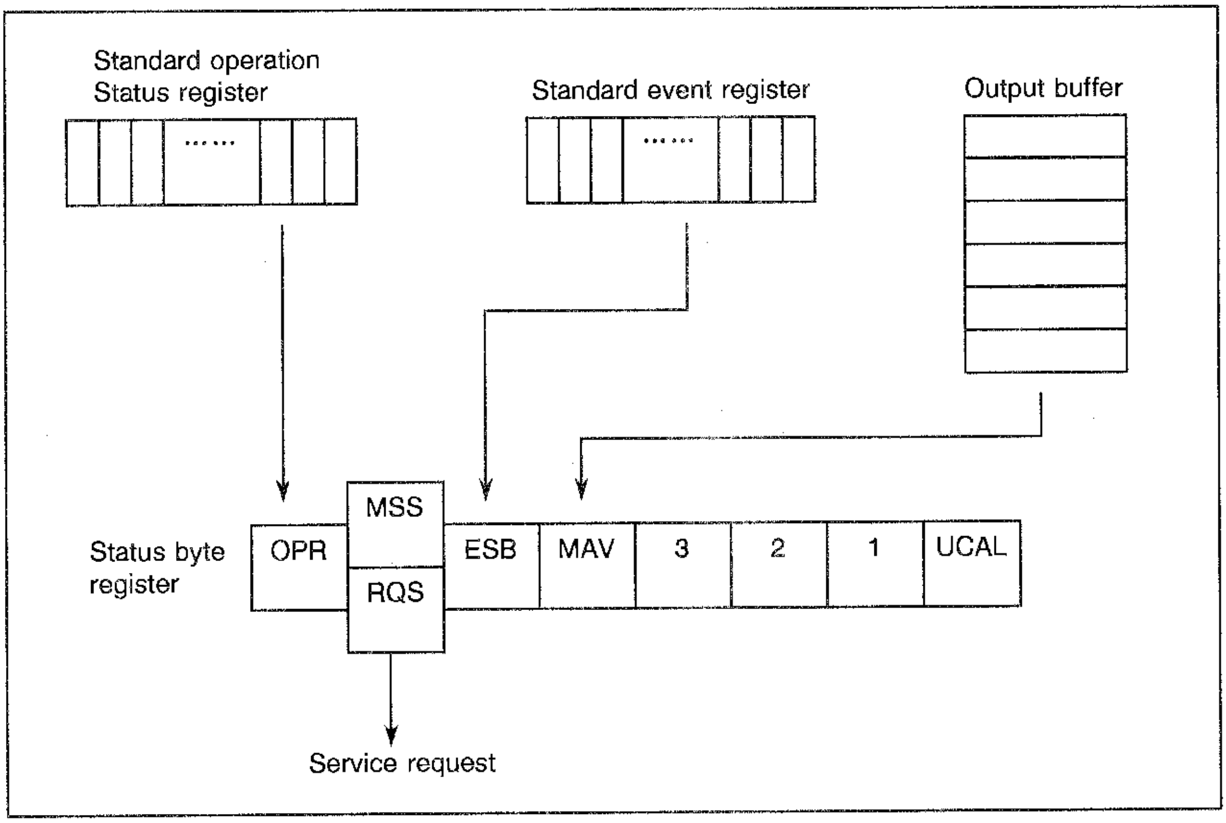
● **Status Register Types**

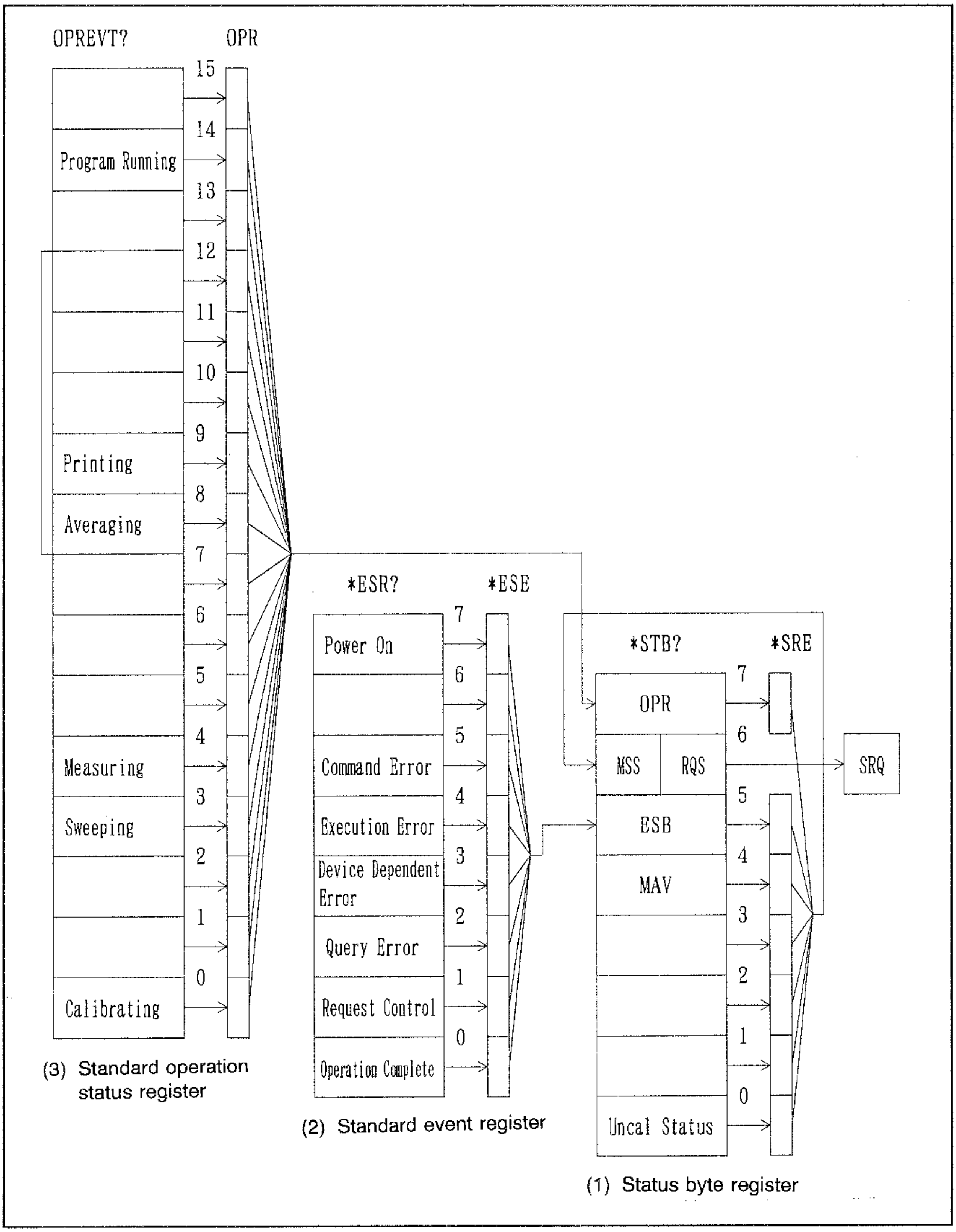
The following three types of status register are used in the analyzer:

(1) Status byte register
(2) Standard event register
(3) Standard operation status register

Refer to page 8-15 for further details.

The figure below shows the arrangement of the status registers in the instrument.





(3) Standard operation status register

(2) Standard event register

(1) Status byte register

Event Enable Register

Each event register has the enable register to determine which bit to be available. The enable register sets the corresponding bit in decimal value.

- Set of Service Request Enable Register : *SRE
- Set of Standard Event Status Enable Register : *ESE
- Set of Operation Status Enable Register : OPR

Example : Only the Measuring bit in the operation status register is made to be available.
OPR bit of the status byte register is set in 1 when Measuring bit of the operation status register in set in 1.

PRINT @8 ;"OPR16"	(The example of the program in N88BASIC.)
OUTPUT 708 ;"OPR16"	(The example of the program in the series of HP200 and 300.)

Example : OPR (the summery of Operation Status Register) bit and ESB (the summery of Event Status Register) bit of the status byte register are made to be available.
MSS bit of the status byte register inset in 1 when OPR bit or ESB bit is set in 1.

PRINT @8 ;"*SRE160"	(The example of the program in N88BASIC.)
OUTPUT 708 ;"*SRE160"	(The example of the program in the series of HP200 and 300.)

Standard Operation Status Register

- Event register

The event register for the standard operation status is used to hold the change from 1 to 0 of the corresponding condition register. The table below shows the assignments of the event register for the standard operation status.

bit		Description
15		Always 0
14	Program running	Set to 1 when the built-in BASIC language stops.
13 to 10		Always 0
9	Printing	Set to 1 at the end of printing.
8	Averaging	Set to 1 when averaging finishes.
7 to 5		Always 0
4	Measuring	Set to 1 at the end of sequence measurement.
3	Sweeping	Set to 1 when sweeping finishes.
2 to 1		Always 0
0	Calibrating	Set to 1 when calibration data acquisition finishes.

■ Status Byte Register

The status byte register summarizes the information from the status register (see Page 8-13). In addition, a summary of the status byte register is sent to the controller as a service request. Therefore, the register operates slightly differently from the status register. This section explains the status byte register.

The figure below shows the structure of the status byte register.

Status byte register

OPR	RQS 6 MSS	ESB	MAV	3	2	1	UCAL

SRQ enable register

			⊗					
7	×	5	4	3	2	1	0	⊕→MSS

The register has the same functions as the status register explained in Page 8-13, except with regard to the following three points:

① The summary of the status byte register is written in bit 6 of the status byte register.
② Bit 6 of the enable register is always valid and cannot be changed.
③ Bit 6 (MSS) of the status byte register writes the RQS of the service request.

The register responds to the serial polling from the controller. On doing so, bits 0 to 5 and bit 7 of the status byte register and the RQS are read out, then the RQS is reset to 0. The other bits are not cleared until each factor has been reset to 0.

When the *CLS command and the S2 command are executed, the status byte register, the RQS bit and the MSS bit can be cleared.

The table below explains the meanings of the bits in the status byte register.

bit		Description
7	OPR	• The OPR bit is a summary of the standard operation status register.
6	MSS	• The RQS bit is true when the MSS bit of the status byte register is set to 1. The MSS bit is the summary bit for the entire status data structure. • The serial poll cannot read out the MSS bit. (However, the MSS bit is understood to be 1 when the RQS bit is 1.) • To read the MSS bit, use the common command *STB?.The *STB? command can read out bits 0 to 5 and bit 7 of the status byte register and the MSS bit. In this case, neither the status byte register nor the MSS bit can be cleared. • The MSS bit cannot become 0 until all the unmasked factors in the status register structure have been cleared.
5	ESB	• The ESB bit is a summary of the standard event register.
4	MAV	• Summary bit for the output buffer. • This instrument does not work with it.
3 to 1		• Always 0
0	UCAL	• Set to 1 when sweep is so fast as to cause signal level error.

Standard Event Register

The table below shows the assignments of the standard event register.

bit		Description
7	Power on	Set to 1 when this instrument is switched on
6		Always 0
5	Command Error	Set to 1 when the purser finds a syntax error.
4	Execution Error	Set to 1 when the system fails to execute the instruction received as a GPIB command for some reason (such as out-of-range parameter).
3	Device Dependent Error	Set to 1 when errors other than command errors, execution errors, or query errors occur.
2	Query Error	Set to 1 when no data exist or data have been deleted when the controller attempts to read out data from this instrument.
1	Request Control	Set to 1 when this instrument is required to be the active controller.
0	Operation Complete	Not used.

5. List of GPIB Command Codes

Note on Table

- An asterisk (*) in the Listener Code column indicates that it is the function that needs the input of the numeric data following the code.
- A plus sign (+) in the Output Formats column indicates that multiple data items are output.
- AUTO/MANUAL or ON/OFF in the Output Formats column indicates that the code outputs 1 or 0, respectively.
- "-" means impropriety.
- All frequencies are in Hertz (Hz), and all times are in seconds or fractions of a second. And the levels are output in the setting display unit.

	Function	Listener code	Talker request		Remarks
			Code	Output format	
Frequency	**Center frequency**	CF *	CF?	Frequency	
	CF Step size	CS *	CS?	Frequency	
	CF Step AUTO	CA	CA?	AUTO/MANUAL	
	Frequency offset size	FO *	FO?	Frequency	
	Frequency offset ON	FON *	-	-	
	Frequency offset OFF	FOF	-	-	
	Frequency span	SP *	SP?	Frequency	
	Full span	FS	-	-	
	Zero span	ZS	-	-	
	Start frequency	FA *	FA?	Frequency	
	Stop frequency	FB *	FB?	Frequency	
	Mixer state	-	MXR?	Internal (0)/External (1)	
	Internal mixer	MXI	-	-	
	External mixer	MXE	-	-	
	Positive bias	MXP *	MXP?	Level	
	Negative bias	MXN *	MXN?	Level	
	Band N	BND *	BND?	Integer	
	Band lock	-	BNDLC?	-	
	Band lock ON	BNDLC ON	-	-	
	Band lock OFF	BNDLC OFF	-	-	
	Signal ident	-	SIGID?	ON/OFF	
	Signal ident ON	SIGID ON	-	-	
	Signal ident OFF	SIGID OFF	-	-	

(cont'd)

	Function	Listener code	Talker request Code	Talker request Output format	Remarks
Frequency	Avg Loss mode	AGL *	AGL?	Level	
	Avg Loss ON	AGL ON	-	-	
	Avg Loss OFF	AGL OFF	-	-	
	Loss vs. Freq mode	-	LVF?	ON/OFF	
	Loss vs. Freq ON	LVF ON	-	-	
	Loss vs. Freq OFF	LVF OFF	-	-	
	Loss vs. Freq input	LVFIN * ※	-	-	* = F, L, A
	Loss vs. Freq deletion	LVFDEL	-	-	
	Pre-selection				
	Auto peaking	PPA	-	-	
	Manual peaking	PPM *	PPM?	Integer	
Reference level	**Reference level**	RL *	RL?	Level	
	X dB/div	DD *	DD?	0: 10 dB/ 1: 5 dB/ 2: 2 dB/ 3: 1 dB/ 4: 0.5 dB/	
	LINEAR	-	LN?	0: ×1 1: ×2 2: ×5 3: ×10	
	LINEAR ×1	LL1	-	-	
	LINEAR ×2	LL2	-	-	
	LINEAR ×5	LL5	-	-	
	LINEAR ×10	LL10	-	-	
	Reference level display unit	- - -	UNIT? UN? AUNITS?	0: dBm 1: dBmV 2: dBμV 3: dBμVemf 4: dBpW 6: V 7: W	
	dBm	AUNITS DBM KSA UB	- - -	- - -	
	dBmV	AUNITS DBMV KSB UM	- - -	- - -	

※: LVFIN sets the table data after this code. The table data is organized with the frequency, the level and the bias.

(cont'd)

	Function		Listener code	Talker request		Remarks
				Code	Output format	
Reference level	dBμV		AUNITS DBUV	-	-	
			KSC	-	-	
			UU	-	-	
	dBμVemf		UE	-	-	
	dBpW		UW	-	-	
	volts		AUNITS V	-	-	
			KSD	-	-	
	watts		AUNITS W	-	-	
	Level offset		RO *	RO?	Level	
	Level offset ON		RON *	-	-	
	Level offset OFF		ROF	-	-	
Sweep condition	**Sweep mode**		-	SWM?	0 : Normal & full 20 : Single & full 1 : Normal & window 21 : Single & window	
	Window	ON	WDOSWP ON	-	-	
		OFF	WDOSWP OFF	-	-	
	Normal		CONTS	-	-	
			SN	-	-	
	Single		SNGLS	-	-	
			SI	-	-	
	Reset & Start		SR	-	-	
	Take sweep (Single sweep action)		TS	-	-	
	Gate Position		GTPOS *	GTPOS?	Time data	
	Gate Width		GTWID *	GTWID?	Time data	
	Gated SWP	ON	GTSWP ON	GTSWP?	ON/OFF	
		OFF	GTSWP OFF			
	Gate Source					
	EXT Gate in		GTSRC GT	-	1 : EXT Gate in	
	EXT Trigger		GTSRC EXT	-	2 : EXT Trigger	

(cont'd)

Function		Listener code	Talker request: Code	Talker request: Output format	Remarks
Sweep condition	Gate Source Slope +	GTSLP +	-	-	
	-	GTSLP-	-	-	
	Trigger mode	-	TM?	0 : FREE RUN 1: LINE 2 : VIDEO 5 : External	
	FREE RUN	TM FREE	-	-	
		FR	-	-	
	LINE	TM LINE	-	-	
		LI	-	-	
	VIDEO	VI	-	-	
	External	TM EXT	-	-	
		EX	-	-	
	Trigger slope +	TRIGSLP +	-	-	
	−	TRIGSLP −	-	-	
	Trigger level	TR*	TR?	-	
	SWP	SW *	SW?	Time	
		ST *	ST?	Time	
	SWP AUTO	AS	AS?	AUTO/MANUAL	
Bandwidth	**RBW**	RB *	RB?	Frequency	
	RBW AUTO	BA	BA?	AUTO/MANUAL	
	RBW : SPAN	CORS *	CORS?	Ratio	
	RBW : SPAN ON	CORS ON *	-	-	
	RBW : SPAN default	CORS OFF	-	-	
	VBW	VB *	VB?	Frequency	
	VBW AUTO	VA	VA?	AUTO/MANUAL	
	VBW : RBW	COVR*	COVR?	Ratio	
	VBW : RBW ON	COVR ON*	-	-	
	VBW : RBW default	COVR OFF	-	-	
	Couple All AUTO	AL	AL?	AUTO/MANUAL	
ATT	**ATT**	AT *	AT?	Level	
	ATT AUTO	AA	AA?	AUTO/MANUAL	
	MIN. ATT	ATMIN *	ATMIN?	Level	
	MIN. ATT ON	ATMIN ON *	-	-	
	MIN. ATT default	ATMIN OFF	-	-	

(cont'd)

	Function	Listener code	Talker request Code	Talker request Output format	Remarks
Trace	**Trace A**	-	TA?	(Lower byte) 0 : write 1 : view 2 : blank 3 : A-DL→A 4 : A-B→A 5 : B-A→A (Upper byte) 0 : nothing 1 : + max hold 2 : + averaging 3 : + min hold	
	A write	AW	-	-	
	A view	AV	-	-	
	A blank	AB	-	-	
	A max hold	AM	-	-	
	A min hold	AMIN	-	-	
	A averaging	AG *	AG?	Integer	
	start	AGR	-	-	
	stop	AGS	-	-	
	pause	AGP	-	-	
	continue	AGC	-	-	
	1 time	AG1	-	-	
	continue	AG0	-	-	
	Trace A clear	CWA	-	-	
	Trace Math				
	A XCH B	ACHB	-	-	
	A-B→A	TR0	-	-	
	B-A→A	TR1	-	-	
	A-DL→A	TR2	-	-	
	Trace B	-	TB?	(Lower byte) 1 : view 2 : blank (upper byte) 0 : nothing	
	B store	BSTORE	-	-	
	B view	BV	-	-	
	B blank	BB	-	-	

(cont'd)

	Function	Listener code	Talker request Code	Talker request Output format	Remarks
Trace	Measurment point				
	501 point	TPS	-	-	
	1001 point	TPL	-	-	
Trace detector	**Detector mode**	-	DM?	0 : Normal	
		-	DET?	1 : Positive	
				2 : Negative	
				3 : Sample	
	Normal	DTN	-	-	
		DET NRM	-	-	
	Positive	DTP	-	-	
		DET POS	-	-	
	Negative	DTG	-	-	
		DET NEG	-	-	
	Sample	DTS	-	-	
		DET SMP	-	-	
Limit line	**Limit line**				
	X-axis				
	ABS	LIMPOS ABS	LIMPOS?	0 : ABS	
	REL	LIMPOS REL		1 : REL	
	Y-axis				
	ABS	LIMAPOS ABS	LIMAPOS?	0 : ABS	
	REL	LIMAPOS REL		1 : REL	
	Limit line 1				
	ON	LAN	LMTA?	ON/OFF	
	OFF	LAF			
	Limit line 2				
	ON	LBN	LMTB?	ON/OFF	
	OFF	LBF			
	Table type selection				
	Frequency domain	LIMTYP FREQ	LIMTYP?	0 : FREQ	
	Time domain	LIMTYP TIME		1 : TIME	
	Limit line 1				
	Table input	LMTAIN * (Note)	-	-	* = F, L
	Table delete	LMTADEL	-	-	
	Limit line 2				
	Table input	LMTBIN * (Note)	-	-	* = F, L
	Table delete	LMTBDEL	-	-	
	X-axis shift	LIMSFT *	LIMSFT?	Frequency or time	
	Y-axis shift	LIMASFT *	LIMASFT?	Level	

(Note) : Table data is described following this code for LMTAIN or LMTBIN.
Table data is formed by the frequency, time and level.
Refer to the programming example of PC-6 (8-40 page) for guideline.

(cont'd)

	Function	Listener code	Talker request Code	Talker request Output format	Remarks
Limit line	**Pass/Fail Judgment**				
	Judgment result?	-	PFJ?	0 : FAIL 1 : PASS	
	Judgment result? (details)	-	OPF?	0 : FAIL 1 : UPPER 2 : LOWER 3 : UPPER&LOWER 4 : ERROR	
	Read out fail point				Maximum
	Upper side	-	FPU?	The number of Fail point. <CR/FR> + Frequency, Level <CR/LF>	256sets
	Lower side	-	FPL?	The same as Upper side.	
Display line	**Display line**	DL *	DL ?	Level	
	Display line ON	DLN *	-	-	
	Display line OFF	DLF	-	-	
Marker	**Marker ON**	MN *	MN?	0 : Marker off	
		MKN *	-	1 : Normal marker 2 : ΔMarker Frequency Level	
	Marker frequency	-	MF?	Frequency	
	Marker Level	-	ML?	Level	
	Frequency + Level	-	MFL?	Frequency + Level	
	Normal marker	MKN *	-	-	
		MK *	MK?	Frequency	
	ΔMarker	MKD *	-	-	
		MT *	MT?	Frequency	
	Fixed Marker	-	FX?	ON/OFF	
	Fixed Marker ON	FXN	-	-	
	Fixed Marker OFF	FXF	-	-	
	1/ΔMarker		REDLT?	Operation value (Note)	
	1/ΔMarker ON	REDLT ON	-	-	
	1/ΔMarker OFF	REDLT OFF	-	-	

(cont'd)

	Function	Listener code	Talker request		Remarks
			Code	Output format	
Marker	**Signal track**	-	SG?	ON/OFF	
	Signal track ON	SGN	-	-	
	Signal track OFF	SGF	-	-	
	Peak Search	MKPK	-	-	
		PS	-	-	
	NEXT peak	MKPK NH	-	-	
		NXP	-	-	
	NEXT peak left	MKPK NL	-	-	
		NXL	-	-	
	NEXT peak right	MKPK NR	-	-	
		NXR	-	-	
	MIN search	MIS	-	-	
	NEXT MIN	NXM	-	-	
	Continuously peak				
	Continuously peak ?	-	CP?	ON/OFF	
	Continuously peak ON	CPN	-	-	
	Continuously peak OFF	CPF	-	-	
	Peak range				
	Normal	PSN	-	-	
	Upper side	PSU	-	-	
	Lower side	PSL	-	-	
	Peak ΔY div	DY *	DY?	Real value (0.1 to 10)	
	Marker display				
	Relative value display	MDR	-	-	
	Absolute value display	MDA	-	-	
	Active marker movement				
	Trace A	MKTRACE TRA	MKTRACE?	0 : Blank	
	Trace B	MKTRACE TRB	-	1 : Trace A	
				2 : Trace B	
	Marker OFF	MKOFF	-	-	
		MO	-	-	

(cont'd)

	Function	Listener code	Talker request Code	Talker request Output format	Remarks
Marker	**Multi Marker**				
	Multi Marker ON	MLT	MLT?	ON/OFF	
	Multi Marker OFF	MO	-	-	
	Active marker shift	MN *	-	-	* = Frequency
		MK *	-	-	
	Multi Marker No.1 ON	MLN1 *	-	-	
	Multi Marker No.1 OFF	MLF1	-	-	
	Multi Marker No.2 ON	MLN2 *	-	-	
	Multi Marker No.2 OFF	MLF2	-	-	
	Multi Marker No.3 ON	MLN3 *	-	-	
	Multi Marker No.3 OFF	MLF3	-	-	
	Multi Marker No.4 ON	MLN4 *	-	-	
	Multi Marker No.4 OFF	MLF4	-	-	
	Multi Marker No.5 ON	MLN5 *	-	-	
	Multi Marker No.5 OFF	MLF5	-	-	
	Multi Marker No.6 ON	MLN6 *	-	-	
	Multi Marker No.6 OFF	MLF6	-	-	
	Multi Marker No.7 ON	MLN7 *	-	-	
	Multi Marker No.7 OFF	MLF7	-	-	
	Multi Marker No.8 ON	MLN8 *	-	-	
	Multi Marker No.8 OFF	MLF8	-	-	
	Multi Marker No.9 ON	MLN9 *	-	-	
	Multi Marker No.9 OFF	MLF9	-	-	
	Multi Marker No.10 ON	MLN10 *	-	-	
	Multi Marker No.10 OFF	MLF10	-	-	
	Multi Marker all frequency	-	MLSF?	Frequency	10 items + ΔMKR
	Multi Marker all level	-	MLSL?	Level	10 items + ΔMKR
	Peak list				
	Peak list frequency	PLS FREQ	-	-	
	Peak list level	PLS LEVEL	-	-	
	Peak list off	PLS OFF	-	-	
	Peak list output	-	PKLST?	cnt, frequency 1, level 1, ...frequency n, level n: n = cnt	

(cont'd)

	Function	Listener code	Talker request Code	Talker request Output format	Remarks
Marker	**MKR→**				
	MKR→CF	MKCF	-	-	
		MC	-	-	
	MKR→REF	MKRL	-	-	
		MR	-	-	
	MKR Δ→SPAN	MTSP	-	-	
		DS	-	-	
	MKR→Harm	MKHM	-	-	
		MH	-	-	
	MKR→CF step	MKCS	-	-	
		M0	-	-	
	MKR Δ→CF step	MTCS	-	-	
		M1	-	-	
	MKR Δ→CF	MTCF	-	-	
	MKR →MKR step	MKMKS	-	-	
		M2	-	-	
	MKR Δ→MKR step	MTMKS	-	-	
		M3	-	-	
	MKR step size	MPM *	MPM?	Frequency	
	MKR step AUTO	MPA	MPA?	AUTO/MANUAL	
	PEAK →CF	PKCF	-	-	
	PEAK →REF	PKRL	-	-	
	dB down				
	X dB down width	MKBW *	MKBW?	Level	
	X dB down	XDB	-	-	
	X dB down left	XDL	-	-	
	X dB down right	XDR	-	-	
	X dB relative	DC0	-	-	
	X dB abs. left	DC1	-	-	
	X dB abs. right	DC2	-	-	

(cont'd)

	Function	Listener code	Talker request Code	Talker request Output format	Remarks
Marker	X dB execution state	-	DC?	0 : Relative 1 : Absolute (Left) 2 : Absolute (Right)	
	Continuously dB down?	-	CDB?	OFF/ON	
	Continuously dB down ON	CDB ON	-	-	
	Continuously dB down OFF	CDB OFF	-	-	
Measurement window	**Measurement window**	-	WDO?	ON/OFF	
		-	WN?	ON/OFF	
	Window ON	WDO ON	-	-	
		WN	-	-	
	Window OFF	WDO OFF	-	-	
		WF	-	-	
	Center position : X	WLX *	WLX?	Frequency	
	Window width	WDX *	WDX?	Frequency	
	Couple to Marker	CPLMK ON	CPLMK?	ON/OFF	
		CPLMK OFF	-	-	
Multi-screen	Multi-screen				
	Multi-screen ZOOM	MLTSCR ZM	-	-	
	F/T	MLTSCR FT	-	-	
	RESET	MLTSCR RST	-	-	
	Window position	ZMPOS *	ZMPOS?	Frequency or time	
	Window width	ZMWID *	ZMWID?	Frequency or time	
	Upside screen	SCRSEL TRA	-	-	
	Downside screen	SCRSEL TRB	-	-	
Input	Level Correction		CR?	ON/OFF	
	ON	CR ON	-	-	
	OFF	CR OFF	-	-	
	table input	CRIN * ※	-	-	* = F,L
	table deletion	CRDEL	-	-	
Recall	**Recall**	RC/REG_nn/	-	-	Max eight characters for the file name. "nn" of "REG_nn" is from 01 to 10.
		RC/File name/	-	-	
Save	**Save**	SV/REG_nn/	-	-	
		SV/File name/	-	-	
Delete	**Delete**	DEL/REG_nn/	-	-	
		DEL/File name/	-	-	
Reset	**Instrument Preset**	IP	-	-	

※: CRIN sets the rable data after this code. The table data is organized with the frequency and the level.

(cont'd)

	Function	Listener code	Talker request		Remarks
			Code	Output format	
Printer	Printer command selection				
	ESC/P	PRTCMD ESC	-	-	
	HP PCL	PRTCMD PCL	-	-	
	Execution	HCOPY	-	-	
Plotter	Plotter output				
	The object to be plotted				
	All information	PLALL	-	-	
	Only wave form	PLTRACE	-	-	
	Split size				
	Full size	PLPIC1	-	-	
	Two part split	PLPIC2	-	-	
	Four part split	PLPIC4	-	-	
	Plot positions				
	Center	PLMID	-	-	Mode changes to full size.
	Left	PLLEFT	-	-	Mode changes to the two part split.
	Right	PLRIGHT	-	-	
	Upper left	PLUPLEFT	-	-	Mode changes to four part split.
	Upper right	PLUPRIGHT	-	-	
	Lower left	PLLOWLEFT	-	-	
	Lower right	PLLOWRIGHT	-	-	
	Moving for plot positions				
	Automatic	PLAUTO	-	-	
	Manual	PLMAN	-	-	
	Address mode				
	Talk only	PLTALK ONLY	-	-	
	Specifying address	PLTALK ADRS	-	-	Specifying talker and listener address is necessary by the controller.
	Plot execution	PLOT	-	-	
		HCOPY	-	-	
		OPTPLOT	-	-	Plot is carried out from OPT15.

(cont'd)

	Function	Listener code	Talker request Code	Talker request Output format	Remarks
Bit map file	Image mode				
	Color	HCIMAG COL	-	-	
	Gray scale	HCIMAG GRY	-	-	
	monochorome	HCIMAG MON	-	-	
	RLE compression				
	Off	HCCMPRS OFF	-	-	
	On	HCCMPRS ON	-	-	
	File No.	HCFILE *	-	-	*: Specify file No by HCFILE before execution three digit integer of 000 to 999.
	Execution	HCOPY	-	-	
Hard copy control	Device selection				
	Printer	HCDEV PRT	-	-	
	Plotter	HCDEV PLT	-	-	
	File A	HCDEV MA	-	-	MA: Memory card drive A
	File B	HCDEV MB	-	-	MB: Memory card drive B
	Execution hard copy	HCOPY	-	-	
Calibration	**Calibration**				Other commands are invalid during the execution of CAL.
	CAL ALL	CLA	-	-	
	Total gain cal.	CLG	-	-	
	Input ATT cal.	CLATT	-	-	
		IT0	-	-	
	IF step AMP cal.	CLSTEP	-	-	
		IT1	-	-	
	RBW switch cal.	CLRBW	-	-	
		IT2	-	-	
	Log linearity cal	CLLOG	-	-	
		IT3	-	-	

(cont'd)

	Function	Listener code	Talker request Code	Talker request Output format	Remarks
Calibration	AMPTD MAG cal.	CLMAG	-	-	Other commands are invalid during the execution of CAL.
		IT4	-	-	
	PBW cal.	CLPBW	-	-	
		IT6	-	-	
	Calibration level	CLN*	CL?	Level (-10 to -30 dB) (0.5 dB Step)	
	f compensation	-	FC?	ON/OFF	
	f compensation ON	FC ON	-	-	
		FCN	-	-	
	f compensation OFF	FC OFF	-	-	
		FCF	-	-	
	CAL compensation	-	CC?	ON/OFF	
	CAL compensation ON	CC ON	-	-	
		CCN	-	-	
	CAL compensation OFF	CC OFF	-	-	
		CCF	-	-	
	Calibration of the internal reference	CLREF * CLREF 9999	CLREF?	Integer (-100 to 100)	Record for setup value
Memory card	**Memory card**				MA: (A:) or MB: (B:) is available for the drive name.
	Memory card initialization	MMI /A: /	-	-	
		MMI /B: /			
	ALL copy	ALLCOPY /A: B: /	-	-	
	Drive select	DEV /RAM: /	-	-	
		DEV /A: /			
		DEV /B: /			
Label	**Label**	-	LB?	Character string	Max.30 characters
	Label ON	LON /*** /	-	-	Enclose a character with a slash (/).
	Label deletion	LOF	-	-	Note: End with the character unable to display.
Soft key	**Data input correspondence**				
	0 to 9	0 to 9	-	-	
	. (decimal point)	.	-	-	

(cont'd)

	Function		Listener code	Talker request Code	Talker request Output format	Remarks
Soft key	GHz		GZ	-	-	
	MHz		MZ	-	-	
	kHz		KZ	-	-	
	Hz		HZ	-	-	
	mV		MV	-	-	
	mW		MW	-	-	
	dB ratio		DB	-	-	
	mA		MA	-	-	
	Second		SC	-	-	
	Milli second		MS	-	-	
	Micro second		US	-	-	
	ENTER		ENT	-	-	
Trace data	**Trace data I/O**					
	Memory A output	(ASCII)	-	TAA?	5 bytes + delimiter	1 point
		(BINARY)	-	TBA?	2 bytes × 1001 (or 501) points	EOI signal
	Memory B output	(ASCII)	-	TAB?	5 bytes + delimiter	1 point
		(BINARY)	-	TBB?	2 bytes × 1001 (or 501)points	EOI signal
	Memory A input	(ASCII)	TAA	-	-	1 point
		(BINARY)	TBA	-	-	EOI signal
	Memory B input	(ASCII)	TAB	-	-	1 point
		(BINARY)	TBB	-	-	EOI signal
Spectrum	**Power Meas**					
	Average Time		PWTM *	PWTM?	Integer(1 to 999)	
	Average Power	ON	PWAVG ON	-	-	
	Average Power	OFF	PWAVG OFF	-	-	
	Average Power?		-	PWAVG?	Level	
	Total Power	ON	PWTOTAL ON	-	-	
	Total Power	OFF	PWTOTAL OFF	-	-	
	Total Power?		-	PWTOTAL?	Level	
	Channel Power	ON	PWCH ON	-	-	
	Channel Power	OFF	PWCH OFF	-	-	
				PWCH?	Level	
	Carrier Power	ON	PWCARR	PWCARR?	Level	
			(PS)	(MF?)	Frequency	
				(ML?)	Level	

(cont'd)

	Function	Listener code	Talker request Code	Talker request Output format	Remarks
Spectrum	**Counter**	-	COUNT?	ON/OFF	
	Counter value	-	CNRES?(MF?)	Frequency	
	Counter ON	COUNT ON	-	-	
	Resolution : 1 kHz	CN0	-	-	
	100 Hz	CN1	-	-	
	10 Hz	CN2	-	-	
	1 Hz	CN3	-	-	
	Counter OFF	COUNT OFF	-	-	
		CNF	-	-	
	Sound Mode	-	SDMD? SD?	0 : OFF 1 : ON(AM) 2 : ON(FM)	
	Sound ON(AM or FM)	SON	-	-	
	Sound ON(AM)	SAM	-	-	
	Sound ON(FM)	SFM	-	-	
	Sound OFF	SOF	-	-	
	Volume	SDV *	SDV?	Integer	1 to 8
	Volume(Maximum)	VX	-	-	
	Volume(Middle)	VD	-	-	
	Volume(Minimum)	VN	-	-	
	Pause time	PU *	PU?	Time	
	SQELCH	SQE *	SQE?	Level	
	SQELCH ON	SQE ON *	-	-	
	SQELCH OFF	SQE OFF	-	-	
	Noise/Hz	NI *	NI?	Frequency	
	dBm/Hz ON	NIM	-	-	
	dBμV/$\sqrt{Hz}$ ON	NIU	-	-	
	dBc/Hz ON	NIC	-	-	
	Noise/Hz OFF	NIF	-	-	
	Noise/Hz value	-	NIRES? (ML?)	Level	

(cont'd)

	Function	Listener code	Talker request		Remarks
			Code	Output format	
Misc	**Misc**				
	Error Number output	-	ERRNO?	Integer	Refer to error numbers of the message list.
	Delimiter				
	CR LF <EOI>	DL0	-	-	
	LF	DL1	-	-	
	<EOI>	DL2	-	-	
	CR LF	DL3	-	-	
	LF <EOI>	DL4	-	-	
	Service request				
	Interruption ON	S0	-	-	
	Interruption OFF	S1	-	-	
	Status clear	S2	-	-	
	Service request mask	RQS *	RQS?	Decimal corresponding to SRQ bit	
	Product type	-	VER?	-	
	Product type (character strings)	-	TYPE?	character strings + delimiter	
		-	TYP?	character strings + delimiter	
	Revision output	-	REV?	character strings + delimiter	
	Reference signal source				
	(Internal)	RFI	-	-	
	(External)	RFE	-	-	
	CW-OBW				OBW % [%]
	OBW (execute)	OBW	OBW?	<OBW %, OBW value, FC>	OBW value
	OBW %	OBW *	-	-	[%]
	OBW avg times	AVGOBW *	AVGOBW?	Integer	FC [Hz}
	OBW avg times ON	AVGOBW ON	-	-	
	OBW avg times OFF	AVGOBW OFF	-	-	
	OBW set up (User)	OBWST USR	-	-	
	(Define)	OBWST DEF	-	-	
	(Manual)	OBWST MNL	-	-	
	CW-ACP				l1 to u3 [dB]
	ACP (execute)	ACP	ACP?	<l1, u1,l2, u2, l3, u3>	
	ACP CS	ADCH *	-	-	
	ACP BS	ADBS *	-	-	

(cont'd)

	Function	Listener code	Talker request: Code	Talker request: Output format	Remarks
Misc	ACP set up (User)				
	(Define)	ACPST USR	-	-	
	(Manual)	ACPST DEF	-	-	
	ACP screen (Full)	ACPST MNL	-	-	
	(Sepa)	ACPSCR FULL	-	-	
		ACPSCR SEPA	-	-	
	ACP graph ON	ADG ON	-	-	
	OFF	ADG OFF	-	-	
	CW-HARM				f [Hz] I [in levels] f and I make one set. Up to 10 sets of f and I can be output. The set count is the number of HRMNUM?
	HARM (execute)	HARM	HARM?	<f1, l1, f2, l2,...f10, l10>	
	HARM Fund	HRMFND *	HRMFND?	Frequency	
	HARM Number	HRMNUM *	HRMNUM?	Integer	
Common command	Device ID output	-	*IDN?	Maker name (character string) Device type (character string) 0, revision (character string) (Example: A D V A N T E S T , R3272,0,A01)	
	Device initialization	*RST	-	-	
	Clearing of status bytes and related queues	*CLS	-	-	
	Accessing of standard event status enable register	*ESE	*ESE?	Decimal number corresponding to each bit in the register	
	Reading and clearing of standard event status enable register	-	*ESR?	Decimal number corresponding to each bit in the register	
	Accessing of service request enable register	*SRE	*SRE?	Decimal number corresponding to each bit in the register	
	Reading of status byte and MSS bit	-	*STB?	Decimal number corresponding to each bit of status byte	
	Accessing of operation status enable register	OPR	OPR?	Decimal number corresponding to each bit in the register	
	Reading and clearing of operation status register		OPREVT?	Decimal number corresponding to each bit in the register	

6. Sample programs

N88BASIC is used in PC9801 series and HP-BASIC is used in HP200 and 300 series.

Sample programs for PC9801 series (GPIB address = 8)

Example PC-1 : Master reset the device and set center frequency to 30 MHz.

```
10 ISET IFC:ISET REN              ' Execute interface clear and remote enable.
20 PRINT @8;"IP"                  ' Execute master reset.
30 PRINT @8;"CF30MZ"              ' Set center frequency to 30 MHz.
40 STOP
50 END
```

Example PC-2 : Set start frequency to 300 kHz and stop frequency to 800 kHz, and add 50 kHz as frequency offset.

```
10 ISET IFC:ISET REN              '
20 PRINT @8;"FA300KZ"             ' Set start frequency to 300 kHz.
30 PRINT @8;"FB800KZ"             ' Set stop frequency to 800 kHz.
40 PRINT @8;"FON50KZ"             ' Set frequency offset to 50 kHz.
50 STOP
60 END
```

Example PC-3 : Set reference level to 87 dBμV, 5 dB/div and RBW to 100 kHz.

```
10 ISET IFC:ISET REN              '
20 PRINT @8;"UU RL87DB"           ' Set REF level to 87 dBμV.
30 PRINT @8;"DD5DB"               ' Set 5 dB/div.
40 PRINT @8;"RB100KZ"             ' Set RBW to 100 kHz.
50 STOP
60 END
```

Example PC-4 : Assign numeric value to variable.

```
10 ISET IFC:ISET REN              '
20 SPA=8:A=10:B=2:C=20            ' Assign a set value to each variable.
30 PRINT @SPA;"CF",A,"MZ"         ' Set center frequency to 10 MHz.
40 PRINT @SPA;"SP",B,"MZ"         ' Set frequency span to 2 MHz.
50 PRINT @SPA;"AT",C,"DB"         ' Set ATT to 20 dB.
60 STOP
70 END
```

Example PC-5 : Save set data to or recall it from register 5.

```
10  ISET IFC:ISET REN                     '
20  TITLE$="R3272 SPECTRUM Analyzer"      '  Define a label.
30  PRINT @8;"CF30MZ SP1MZ DTP"           '  Set each data.
40  PRINT @8;"LON/"+TITLE$+"/"            '  Label ON
50  PRINT @8;"SV/REG_05/"                 '  Save values in register 5.
60  PRINT @8;"CF1GZ SP200MZ"              '  Change center frequency and frequency
                                             span.
70  PRINT @8;"RC/REG_05/"                 '  Recall values from register 5.
80  STOP
90  END
```

Example PC-6 : Input data to the table for limit line 1 and turn limit line 1 ON.

```
10  ISET IFC:ISET REN
20  PRINT @8;"IP"
30  PRINT @8;"LMTADEL"                    '  Delete the table for limit line 1.
40  PRINT @8;"UU"                         '  Set units to dBμV.
50
60  PRINT @8;"LMTAIN 25MZ,49.5DB"         '  Input data for limit line 1.
70  PRINT @8;"LMTAIN 35MZ,50.5DB"
80  PRINT @8;"LMTAIN 35MZ,51.5DB"
90  PRINT @8;"LMTAIN 55MZ,52.5DB"
100 PRINT @8;"LMTAIN 55MZ,54.3DB"
110 PRINT @8;"LMTAIN 65MZ,55.9DB"
120 PRINT @8;"LMTAIN 65MZ,57.0DB"
130 PRINT @8;"LMTAIN 68MZ,58.0DB"
140 PRINT @8;"LMTAIN 68MZ,60.5DB"
150 PRINT @8;"LMTAIN 75MZ,63.0DB"
160 PRINT @8;"LMTAIN 75MZ,64.0DB"
170 PRINT @8;"LMTAIN 82MZ,64.6DB"
180 PRINT @8;"LMTAIN 82MZ,64.7DB"
190
200 PRINT @8;"FA0MZ FB100MZ"              '  Set start frequency and stop frequency.
210 PRINT @8;"LAN"                        '  Turn limit line 1 ON.
220 STOP
230 END
```

Example PC-7 : Sample measurement with gated sweep

```
10 ISET IFC:ISET REN              ' Execute interface clear and remote enable.
20 PRINT @8;"GTSRC GT"            ' Set gate signal source to EXT.
30 PRINT @8;"GTSLP + "            ' Set trigger at the trailing edge of EXT signal.
40 PRINT @8;"GTWID 10MS"          ' Set gate width to 10 ms.
50 PRINT @8;"GTPOS 10US"          ' Set gate position to 10 us.
60 PRINT @8;"GTSWP ON"            ' Turn gated sweep ON.
70 END
```

Sample programs for HP200 and HP300 series (GPIB address = 1)

Example HP-1 : Master reset the instrument and set center frequency to 30 MHz.

```
10 OUTPUT 701;"IP"
20 OUTPUT 701;"CF30MZ"
30 END
```

Example HP-2 : Set start frequency to 300 kHz and stop frequency to 800 kHz, and add 50 kHz as frequency offset.

```
10 OUTPUT 701;"FA300KZ"
20 OUTPUT 701;"FB800KZ"
30 OUTPUT 701;"FON50KZ"
40 END
```

Example HP-3 : Set reference level to -20 dBm (5 dB/div), resolution bandwidth to 100 kHz and detector mode to Posi.

```
10 OUTPUT 701;"RL-20DB"
20 OUTPUT 701;"DD5DB"
30 OUTPUT 701;"RB100KZ"
40 OUTPUT 701;"DTP"
50 END
```

Example HP-4 : Set trigger mode to SINGLE and sweep time to 2 seconds, and position a marker at the maximum level for each sweep.

```
10 OUTPUT 701;"SI"
20 OUTPUT 701;"SW2SC"
30 OUTPUT 701;"SR"                      ! Start sweep.
40 WAIT 2.5                             ! Wait for sweep end (or use service request).
50 OUTPUT 701;"PS"                      ! Marker peak search
60 GOTO 30
70 STOP
80 END
```

Example HP-5 : Set to MAX HOLD (A).

```
OUTPUT 701;"AM"                         ! Set to DIRECT.
```

Example HP-6 : Accessing the files

```
OUTPUT 701;"RC/REG_05/"                      ! Recall the register 5.
OUTPUT 701;"RC/A: \/SVRCL \/FILE_010.DAT/"   ! Recall values from the card.
OUTPUT 701;"SV/REG_02,PDC Measure/"          ! Save values with the titles.
```

Note: The method of accessing files with RC, DEL, SV command is in the same format. To specify the device name, be sure to specify its full pass name including the directory name.

Data output format (talker)

In order to output internal data such as measured data and set conditions, it is necessary to specify which data to output with "xx?" command. Then the specified data is read when the instrument is in talker mode. Available output formats are as shown in the table below. The delimiter positioned at the end of data can be specified from 5 types (see the item "Others" in GPIB code list). Once set, "xx?" command continues to be valid until it is changed the next.

(1 of 2)

	Output format
Frequency	± DDDDDDDDDDDD E±D CR LF ↑ (1) ↑ (2) ↑ (3) ↑ (4) ● Data size (1 to 3) is maximum 19 bytes, and the unit is Hz.
	Example) Specify "CF?" and output as center frequency.
Level	± DDDDDDDD E±D CR LF ↑ (1) ↑ (2) ↑ (3) ↑ (4) ● Data size (1 to 3) is maximum 19 bytes, and the unit corresponds to each UNIT setting.
	Example) Specify "ML?" and output as maker level.

<Supplement>

1 = Sign (a space for plus sign; "-" for minus sign)
2 = Mantissa of data
3 = Exponent of data
4 = Delimiter (CR/LF in initial setting and it can be changed with "DLn" code.)

(2 of 2)

	Output format
Time	±DDDD E±D CR LF ↑ ↑ ↑ ↑ 1 2 3 4 ● Data size (1 to 3) is maximum 19 bytes, and the unit is sec.
	Example) Specify "SW?" and output sweep time.
Constant	DDDD CR LF ↑ ↑ 2 4 ● The maximum byte of the data size corresponds to the maximum size of the output data.
	Example) ON/OFF status is output or Averaging count is output.

<Supplement>

1 = Sign (a space for plus sign; "-" for minus sign)
2 = Mantissa of data
3 = Exponent of data
4 = Delimiter (CR/LF in initial setting and it can be changed with "DLn" code.)

Sample programs for PC9801 series (GPIB address = 8)

Example PC-8 : Output marker level (numerical variable)

```
10 ISET IFC:ISET REN                   '
20 PRINT @8;"CF30MZ SP1MZ MK30MZ"      ' Center frequency, frequency span, marker
                                         ON
30 PRINT @8;"ML?"                      ' Marker level?
40 INPUT @8;ML                         ' Read marker level.
50 PRINT "MARKER LEVEL = ",ML          ' Display the result.
60 STOP
70 END
```

Sample result: MARKER LEVEL = -16.22

Example PC-9 : Output center frequency (character variable)

```
10 ISET IFC:ISET REN                   '
20 PRINT @8;"CF?"
30 INPUT @8;CF$                        ' Read center frequency.
40 PRINT CF$                           ' Display the result.
50 STOP
60 END
```

Sample result: 30.000E+6

Example PC-10 : Output level and its unit

```
10 ISET IFC:ISET REN                   '
20 PRINT @8;"RL?"
30 INPUT @8;RE$                        ' Read REF level.
40 PRINT @8;"UN?"
50 INPUT @8;UN                         ' Read unit for level.
60 PRINT RE$," : ",UN                  ' Display the result.
70 STOP
80 END
```

Sample result: 0.0E+0 : 0

Example PC-11 : Execute 6 dB down and then output frequency and level values (multiple items).

```
10  ISET IFC:ISET REN               '
20  PRINT @8;"CF30MZ SP20MZ"        '  Set center frequency and frequency span.
30  PRINT @8;"MKBW6DB PS XDB"       '  Execute 6 dB down.
40  PRINT @8;"MFL?"                 '  Read frequency and level for marker position
                                    '  at the same time.
50  INPUT @8;MF,ML
60  PRINT "MARKER FREQ = ";MF;" : MARKER LEVEL = ";ML
70  STOP
80  END
```

Sample result: MARKER FREQ = 400000 : MARKER LEVEL = 1.16

Example PC-12 : Execute CW-OBW and output the result.

```
10  ISET IFC:ISET REN          '
20  PRINT @8;"CF30MZ"          '  Set each data.
30  PRINT @8;"SP10MZ"
40  PRINT @8;"MK30MZ"
50  PRINT @8;"OBW"             '  Execute OBW.
60  PRINT @8;"OBW?"            '  Read the result of OBW.
70  INPUT @8;PER,OBW,FC        '  Percentage, Occuied bandwidth, Carrier wave
                                  frequency
80  PRINT "OBW (";PER;"%) = ";OBW;" : Fc = ";FC
90  STOP
100 END
```

Sample result: OBW(99%) = 171000 : Fc = 2.503E+07

Example PC-13: Output level values for the maximum, 2nd and 3rd peak points of the signal.

```
10  ISET IFC:ISET REN          '
20  PRINT @8;"CF0MZ"           '  Set center frequency and frequency span
30  PRINT @8;"SP100MZ"
40  PRINT @8;"PS"
50  INPUT @8;"ML?"
60  INPUT @8;A                 '  Read peak level.
70  PRINT @8;"NXP"
80  INPUT @8;"ML?"
90  INPUT @8;B                 '  Read 2nd peak level.
100 PRINT @8;"NXP"
110 INPUT @8;"ML?"
120 INPUT @8;C                 '  Read 3rd peak level.
130 PRINT"1st PK = ";A;" : 2nd Pk = ";B;" : 3rd PK = ";C
140 STOP
150 END
```

Sample result: 1st PK = -9.44 : 2nd PK = -10.06 : 3rd PK = -11.84

Example HP-7 : Output marker frequency (integer).

```
10 OUTPUT 701;"MF?"
20 ENTER 701;A
30 END
```

Sample result: A = 1.8E + 9

Example HP-8 : Output center frequency (character string).

```
10 DIM A$[30]
20 OUTPUT 701;"CF?"
30 ENTER 701;A$
40 END
```

Sample result: A$ = 1.234567E + 9

Example HP-9 : Output status of the level unit.

```
10 OUTPUT 701;"UN?"
20 ENTER 701;A
30 END
```

Sample result: A = 2 (dBuV)

Example HP-10 : Output frequency and level values for marker position at the same time (multiple values).

```
10 OUTPUT 701;"MFL?"
20 ENTER 701;Mf,Ml
30 END
```

Sample result: Mf = 1.8E + 9 Ml = -65.15

Example HP-11 : With NEXT PEAK function, read 2nd and following 10 peak levels of the signal.

```
10 DIM Ml(9)
20 OUTPUT 701;"PS"
30 FOR I = 0 TO 9
40 OUTPUT 701;"NXP"
50 OUTPUT 701;"ML?"
60 ENTER 701;Ml(I)
70 NEXT I
80 END
```

Sample result: Ml(0) = -55.01 Ml(1) = -58.22 --Ml(9) = -70.26

■ I/O of trace data

Trace data on the screen includes the data for 1001 or 501 points on frequency axis. For inputting/outputting these data, it is necessary to transfer data for 1001/501 points from leftmost one (start frequency) in order. Each level point is expressed by an integer from 1792 to 14592. (However, when the waveform exceeds the upper limit of the vertical scale, a value greater than 14592 is transferred.)

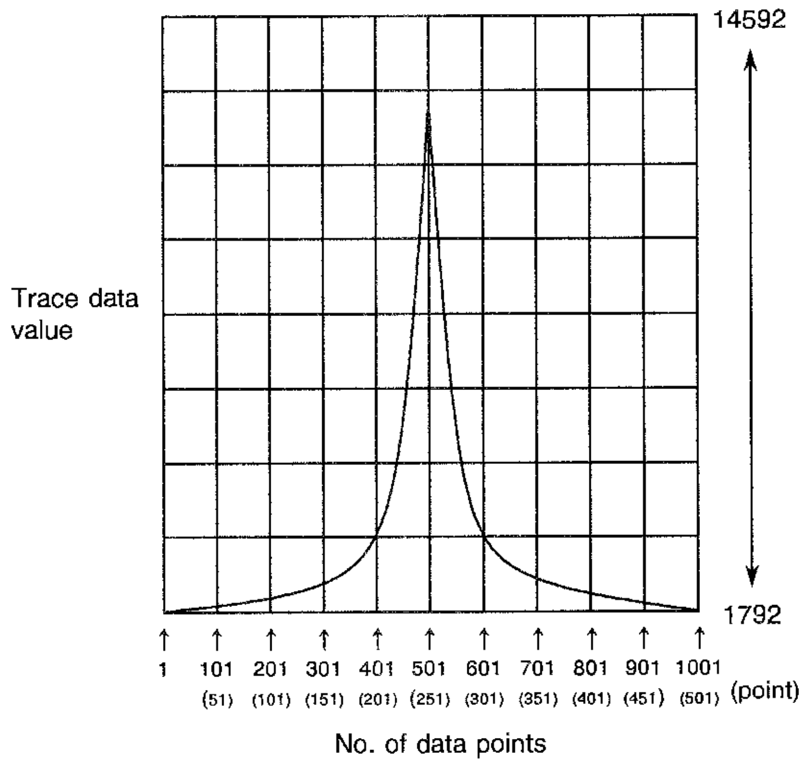


Figure 8-1 Relation between screen grid and trace data

ASCII format and binary format are available for the input and output of the trace data.

Table 8-1 Trace accuracy designation code

GPIB code	Content
TPS	Set the number of measuring points to 501.
TPL	Set the number of measuring points to 1001.

<table>
<tr><th>I/O method</th><th>Content</th></tr>
<tr><td>ASCII format</td><td>
DDDDD CR LF
Data for one point   Delimiter

5-byte data without header
<table>
<tr><th></th><th>Input GPIB code</th><th>Output GPIB code</th></tr>
<tr><td>Memory A</td><td>TAA</td><td>TAA?</td></tr>
<tr><td>Memory B</td><td>TAB</td><td>TAB?</td></tr>
</table>
</td></tr>
<tr><td>Binary format</td><td>
DD DD .... DD DD + EOI
Delimiter
Low-order byte for 1st point   Low-order byte for 1001st/501st point
High-order byte for 1st point   High-order byte for 1001st/501st point

Each point data is divided into two parts: high- and low-order bytes. EOI signal is attached at the end of the data for continuous 1001/501 points.
<table>
<tr><th></th><th>Input GPIB code</th><th>Output GPIB code</th></tr>
<tr><td>Memory A</td><td>TBA</td><td>TBA?</td></tr>
<tr><td>Memory B</td><td>TBB</td><td>TBB?</td></tr>
</table>
</td></tr>
</table>

Sample programs for PC9801 series (GPIB address = 8)

Example PC-14: Output data from memory A in ASCII format.

```
10 ISET IFC:ISET REN              ' Execute interface clear and remote enable.
20 DIM TR(1001)
30 PRINT @8;"DL0 DTG"             ' Set to negative detector.
40 PRINT @8;"TAA?"                ' Specify ASCII output from memory A.
50 FOR I=0 TO 1000
60    INPUT @8;TR(I)              ' Fetch data for 1001 points.
70    PRINT I;"=";TR(I)
80 NEXT I
90 END
```

Sample result: Tr(0)=5208 Tr(1)=5210 .... Tr(999)=5311 Tr(1000)=5298

Example PC-15: Output data from memory A in binary format.

```
10 ISET IFC:ISET REN              ' Execute interface clear and remote enable.
20 DIM TR(1001)
30 PRINT @8;"DL2 DTG"             ' Set to negative detector.
40 PRINT @8;"TBA?"                ' Specify binary output from memory A.
50 WBYTE &H3F,&H5F,&H3E,&H48;     ' Cancel listener and address PC9801 to #30 as
60                                ' listener and this instrument to #8 as talker.
70 FOR I=0 TO 1000
80    RBYTE ;UP,LO                ' Repeat fetching data, high-order bytes for 1001
90    TR(I)=UP*256+LO             ' points and then low-order bytes for 1001 points.
100   PRINT I;"=";TR(I)
110 NEXT I
120 WBYTE &H3F,&H5F;              ' Cancel listener and talker.
130 STOP
140 END
```

Sample result: Tr(0)=6312 Tr(1)=6319 .... Tr(999)=6208 Tr(1000)=6211

Example PC-16 : Input data to memory A in ASCII format.

```
10  ISET IFC:ISET REN               ' Execute interface clear and remote enable.
20  A=0:ST=3.14/100
30  PRINT @8;"AB TAA"               ' Specify ASCII input to memory A.
40  FOR I=0 TO 1000
50     N=INT(SIN(A)*5000)+5000
60     A=A+ST
70     PRINT @8;N
80  NEXT I
90  PRINT @8;"AV"                   ' A VIEW
100 STOP
110 END
```

Example PC-17 : Input data to memory A in binary format.

```
10  ISET IFC:ISET REN               ' Execute interface clear and remote enable.
20  DIM DT(1001)
30  A=0:ST=3.14/100
40  PRINT @8;"AB CWA TBA"           ' Specify binary input to memory A.
50  FOR I=0 TO 1000
60     DT(I)=INT(COS(A)*5000)+5000
70     A=A+ST
80  NEXT I
90                                  ' Cancel listener and address PC9801 to #30 as
100                                 ' talker and this instrument to #8 as listener.
110 WBYTE &H3F,&H5F,&H5E,&H28;DT(0)¥256,DT%(0) MOD 256
120 FOR I=1 TO 999
130    WBYTE ; DT(I)¥256,DT(I) MOD 256  ' Transfer data, first high-order bytes and then
140 NEXT I                          ' low-order bytes.
150 WBYTE ; DT(1000)¥256,DT(1000) MOD 256@ 'When the last data is input, send EOI signal.
160 PRINT @8;"AV"                   ' A VIEW
170 STOP
180 END
```

Sample programs for HP200, HP300 series (GPIB address = 1)

Example HP-12: Output data from memory A in ASCII format.

```
10 DIM Tr(1000)                     ! Reserve 1001 variables.
20 OUTPUT 701;"DL3"                 ! Set delimiter to CR LF.
30 OUTPUT 701;"TAA?"                ! Specify ASCII output from memory A.
40 FOR I=0 TO 1000                  ! Repeat data fetching 1001 times.
50 ENTER 701;Tr(I)                  !
60 NEXT I                           !
70 END
```

Sample result: Tr(0)=5208 Tr(1)=5210 .... Tr(999)=5311 Tr(1000)=5298

Example HP-13: Output data from memory B in binary format.

```
10 DIM Tr(1000)                     ! Reserve 1001 variables.
20 OUTPUT 701;"DL2"                 ! Set delimiter to EOI.
30 OUTPUT 701;"TBB?"                ! Specify binary output from memory B.
40 ENTER 701 USING "%,W";Tr(*)      ! Repeat word type conversion and data fetching till
50 END                              ! EOI is encountered.
```

Sample result: Tr(0)=6312 Tr(1)=6319 .... Tr(999)=6208 Tr(1000)=6211

Note

For ASCII data, be sure to set the number of I/O operations to 1001.For binary data, reserve data for 1001 points, and set EOI for delimiter.

Example HP-14 : Input data to memory A in ASCII format.

```
10  INTEGER Tr(1000)              !
20  OUTPUT 701;"TAA"              ! Specify ASCII input to memory A.
30  FOR I=0 TO 1000               ! Repeat inputting variable Tr (1001 variables reserved)
40  OUTPUT 701;Tr(I)              ! 1001 times.
50  NEXT I                        !
60  END
```

Note

It is necessary to set to VIEW mode before executing the program. After the program has been executed, pressing VIEW key again enables to check the result of input.

Example HP-15 : Input data to memory B in binary format.

```
10  INTEGER Tr(1000)                   !
20  OUTPUT 701;"TBB"                   ! Specify binary input to memory B.
30  OUTPUT 701 USING "#,W";Tr(*),END   ! Input 1001 pieces of word size data and attach
40  END                                ! EOI following the last data.
```

Note

It is necessary to set to VIEW mode before executing the program. After the program has been executed, pressing VIEW key again enables to check the result of input.

Note

For ASCII data, be sure to set the number of I/O operations to 1001.
For binary data, reserve data for 1001 points, and set EOI for delimiter.

● Example of the program with using the status byte

Sample programs for PC9801 series (GPIB address = 8)

Example PC-18: Execute single sweeping and wait the end of the sweeping (In the case of not using SRQ signal)

```
10  ISET IFC:ISET REN               '  Send IFC signal and set REN signal in 1.
20  SPA=8                           '  Set GP-IB address (8) in a variable.
30  PRINT @SPA;"SI"                 '  Set in the single sweeping mode.
40  PRINT @SPA;"OPR8"               '  Make Sweep-end bit of operation status
50                                  '  register enable.
60  PRINT @SPA;"*CLS"               '  Clear the status byte.
70  PRINT @SPA;"TS"                 '  Begin the sweeping.
80  *LOOP                           '
90  PRINT @SPA;"*STB?" : INPUT @SPA;S   '  Read the status byte.
100 IF (S AND 128)=0 THEN GOTO *LOOP    '  Wait until the operation status bit (end of
110                                     '  sweeping) is set in 1.
120 STOP
```

Example PC-19: Execute CW-ACP measurement and begin the reading of the result after the measurement is ended.

```
10  ISET IFC:ISET REN               '  Send IFC signal and set REN signal in 1.
20  SPA=8                           '  Set GP-IB address (8) in a variable.
30  PRINT @SPA;"ACPST MNL"           '  Set the condition of ACP measurement in 'Manual'.
40  PRINT @SPA;"CF1500MZ"            '  Set the center frequency in 1500MHz.
50  PRINT @SPA;"SP250KZ"             '  Set the frequency span in 250kHz.
60  PRINT @SPA;"RB1KZ; VB3KZ"        '  Set RBW in 1kHz and VBW in 3kHz.
70  PRINT @SPA;"ST20SC"              '  Set the sweeping time in 20 seconds.
80  PRINT @SPA;"ADCH50KZ"            '  Set the channel space in 50kHz.
90  PRINT @SPA;"ADBS21KZ"            '  Set the band width in 21kHz.
100 PRINT @SPA;"OPR16"               '  Make the Measuring bit of the operation
110                                  '  status register enable.
120 PRINT @SPA;"*CLS"                '  Clear the status byte.
130 PRINT @SPA;"ACP"                 '  Begin ACP measurement.
140 *LOOP
150 PRINT @SPA;"*STB?" : INPUT @SPA;S   '  Read the status byte.
160 IF (S AND 128)=0 THEN GOTO *LOOP    '  Wait the end of ACP measurement.
170 PRINT @SPA;"ACP?"            '  Demand the output of the result of ACP measurement.
180 INPUT @SPA;LO,UP             '  Read the result of ACP measurement.
190 PRINT "-50K:";LO;" ,-50K:";UP'  Display the result of the Measurement.
200 STOP                         '
```

Example PC-20: Read the peak frequency and the level on every end of single sweeping. (In the case of using SRQ signal.)

```
10  ISET IFC:ISET REN                          ' Send IFC signal and set REN signal in 1.
20  SPA=8                                      ' Set GP-IB address (8) in a variable.
30  PRINT @SPA;"SI"                            ' Set in single sweeping mode.
40  ON SRQ GOSUB *SSRQ                         ' Define the SRQ interrupt processing routine.
50  PRINT @SPA;"*CLS"                          ' Clear the status byte.
60  PRINT @SPA;"OPR8"                          ' Make the Sweep-end bit of the operation
                                                 status register enable.
70  PRINT @SPA;"*SRE128"                       ' Make the Operation Status bit of the status
                                                 byte enable.
80  PRINT @SPA;"S0"                            ' Specify the sending out mode of SRQ
                                                 signal.
90  *LOOP
100 SEND=0                                     ' Clear the Sweep-end flag.
110 PRINT @SPA;"TS"                            ' Begin the sweeping.
120 SRQ ON                                     ' Make the SRQ interruption of PC enable.
130 *WINT
140 IF SEND = 0 THEN GOTO *WINT                ' Wait until SRQ interruption occurs.
150 PRINT @SPA;"PS"                            ' Execute the peak search.
160 PRINT @SPA;"MFL?"                          ' Demand the output of the marker data.
170 INPUT @SPA;MF,ML                           ' Read the peak frequency and the level.
180 PRINT "Peak Freq:";MF;" ,Peak Level:";ML   ' Display the read data.
190 GOTO *LOOP                                 ' Repeat the sweeping.
200 '
210 *SSRQ                                      ' SRQ interrupt processing routine.
220 POLL SPA,S                                 ' Read the status byte.
230 SEND=1                                     ' Set the Sweep-end flag in 1.
240 RETURN                                     ' Return to the main routine.
250 '
260 END
```

Sample programs for HP200, HP300 series (GPIB address = 1)

Example HP-16: Execute the sweeping and wait the end of the sweeping. (In the case of not using SRQ signal.)

```
10  Spa=708                            ! Set GP-IB address (8) in a variable.
20  OUTPUT Spa;"SI"                    ! set in the single sweeping mode.
30  OUTPUT Spa;"OPR8"                  ! Make the Sweep-end bit of the operation status
40                                     ! register enable.
50  OUTPUT Spa;"*CLS"                  ! Clear the status byte.
60  OUTPUT Spa;"TS"                    ! Begin the sweeping.
70  Mloop: !
80  OUTPUT Spa;"*STB?"                 ! Demand the output of the status byte.
90  ENTER Spa;S                        ! Read the status byte.
100 IF BIT(S,7)=0 THEN GOTO Mloop      ! Wait until the operation status bit (end of
110                                    ! sweeping) is set in 1.
120 STOP
130 END
```

Example HP-17: Execute CW-ACP measurement and read out the result after the end of the measurement. (In the case of not using SRQ signal.)

```
10  Spa=708                            ! Set GP-IB address (8) in a variable.
20  OUTPUT Spa;"ACPST MNL"             ! Set the condition of ACP measurement in 'Manual'.
30  OUTPUT Spa;"CF1500MZ"              ! Set the center frequency in 1500MHz.
40  OUTPUT Spa;"SP250KZ"               ! Set the frequency span in 250kHz.
50  OUTPUT Spa;"RB1KZ; VB3KZ"          ! Set RBW in 1kHz and VBW in 3kHz.
60  OUTPUT Spa;"ST20SC"                ! Set the sweeping time in 20 seconds.
70  OUTPUT Spa;"ADCH50KZ"              ! Set the channel space in 50kHz.
80  OUTPUT Spa;"ADBS21KZ"              ! Set the band width in 21kHz.
90  OUTPUT Spa;"OPR16"                 ! Make the Measuring bit of the operation status
100                                    ! register enable.
110 OUTPUT Spa;"*CLS"                  ! Clear the status byte.
120 OUTPUT Spa;"ACP"                   ! Begin ACP measurement.
130 Mloop: !
140 OUTPUT Spa;"*STB?"                 ! Demand the output of the status byte.
150 ENTER Spa;S                        ! Read the status byte.
160 IF BIT(S,7)=0 THEN GOTO Mloop      ! Wait the end of ACP measurement.
170 OUTPUT Spa;"ACP?"                  ! Demand the output of the result of ACP measurement.
180 ENTER Spa;Lo,Up                    ! Read the result of ACP measurement.
190 PRINT "-50K:";Lo;" , +50K:";Up     ! Display the result of the Measurement.
200 END
```

Example HP-18 : Read te peak frequency and the level on every end of the single sweeping. (In the case of using SRQ signal.)

```
10  Spa=708                          ! Set GP-IB address (8) in a variable.
20  OUTPUT Spa;"SI"                  ! Set in single sweeping mode.
30  ON INTR 7 GOSUB Ssrq             ! Define the SRQ interrupt processing routine.
40  OUTPUT Spa;"*CLS"                ! Clear the status byte.
50  OUTPUT Spa;"OPR8"                ! Make the Sweep-end bit of the operation status
60                                   ! register enable.
70  OUTPUT Spa;"*SRE128"             ! Make the Operation Status bit of the status byte
80                                   ! enable.
90  OUTPUT Spa;"S0"                  ! Specify the sending out mode of SRQ signal.
100 Mloop: !
110 Mend=0                           ! Clear the Sweep-end flag.
120 OUTPUT Spa;"TS"                  ! Begin the sweeping.
130 ENABLE INTR 7;2                  ! Make the SRQ interruption enable.
140 Wint: !
150 IF Mend = 0 THEN GOTO Wint       ! Wait until SRQ interruption occurs.
160 OUTPUT Spa;"PS"                  ! Execute the peak search.
170 OUTPUT Spa;"MFL?"                ! Demand the output of the marker data.
180 ENTER Spa;MF,ML                  ! Read the peak frequency and the level.
190 PRINT "Peak Freq:";MF;" ,Peak Level:";ML    ! Display the read data.
200 GOTO Mloop                       ! Repeat the sweeping.
210     !
220 Ssrq:                            ! SRQ interrupt processing routine.
230 S=SPOLL(Spa)                     ! Read the status byte.
240 Mend=1                           ! Set the Sweep-end flag in 1.
250 RETURN                           ! Return to the main routine.
260     !
270 END
```

7. RS-232 Remote Control Function

The controller (such as personal computer and other) does not have GPIB interface, almost controllers have RS-232C interface, therefore, Spectrum Analyzer can be controlled using by it.

■ Compatibility of GPIB remote control and RS-232C remote control

Available control codes to use in the serial control is the same control codes except that the specific codes and the functions to the GPIB and some commands.

■ Setup for the measurement conditions

The following functions can be controlled for serial control.

- Setup for the measurement conditions :
  Each measurement conditions can be input in much the same as the key operation on the front panel.
- Output of the setup status:
  Each setup status and the data of the Spectrum Analyzer can be read out.
- Status output:
  Status bytes which is shown the current status of the Spectrum Analyzer can be read out as read out by GPIB.

Activation of the remote control

Press the key of LCL and RS232 then the setup menu of serial port is displayed.

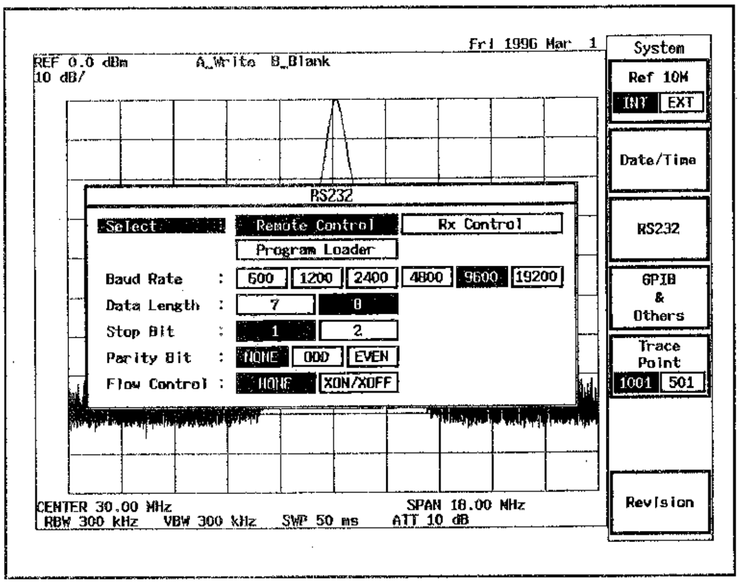


Figure 8-2 Selected window of serial port (OPT08 and OPT15 are already installed)

Select Remote Control on the selection window for activation of the remote control.

Note

If OPT08 is installed then Rx Control is displayed and can be selected.
If OPT15 is installed then Program Loader is displayed and can be selected.
****: OPT08 is an option only for R3465 and R3463.***

■ Parameter setup window

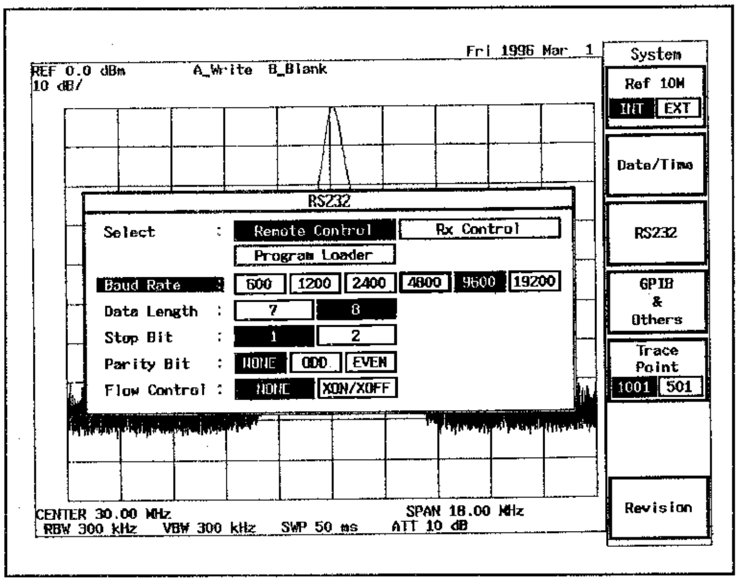


Figure 8-3 Parameter setup

Transmission speed : Select the transmission speed in (600), (1200), (2400), (4800), (9600) and (19200).
Data length : Select seven bits or eight bits of the number of data bit.
Stop bit : Select one bit or two bits of stop bit.
Parity check : Select from (NONE), (ODD) or (EVEN).
Flow control : Select using by XON/XOFF or not.

Note

If parameters of the serial port are changed by the control command of OPT15 then changed values are inherited.
Moreover, if Rx test mode is specified by OPT08 then specific parameter is set.
Ensure the value of parameters again before execution of the remote control.
**** : OPT08 is an option only for R3465 and R3463.***

■ Interface connection

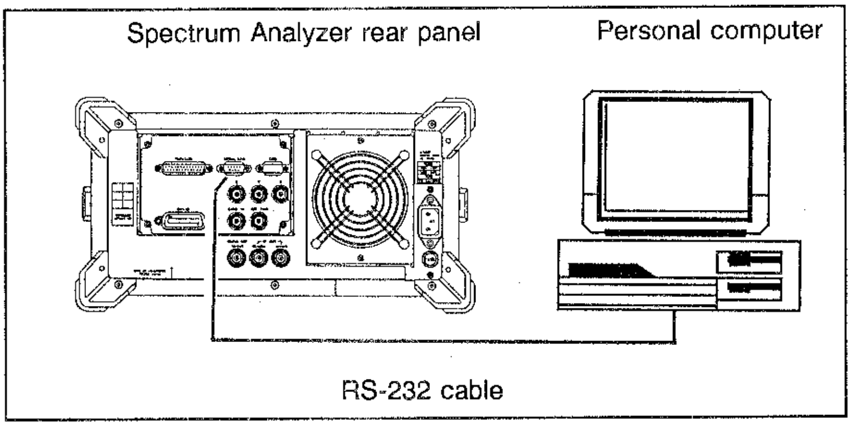


Figure 8-4 Connection of the controller and Spectrum Analyzer

The numbers of connection wires of the Spectrum Analyzer side are three wires and the controller side needs more connections for input and output interface.

Note

Line control is different compared with the terminal emulation.

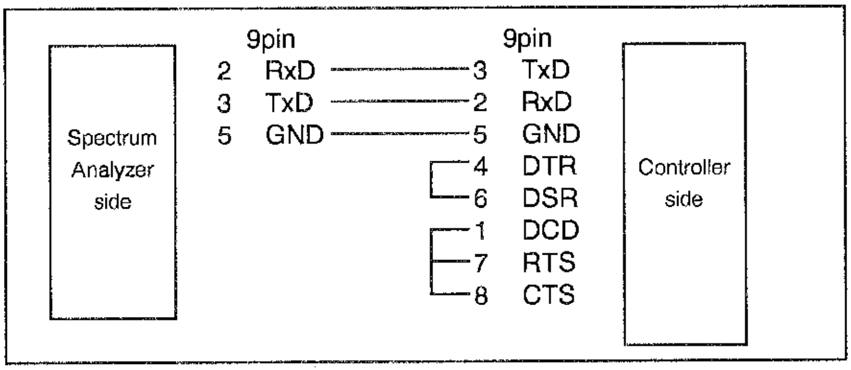


Figure 8-5 Cable wiring diagram

Pin No.(9pin)	Signal name	Contents
1	DCD:Data Carrier Detector	Receive carrier detection
2	RxD:Receive Data	Receive data
3	TxD:Transmit Data	Transmission data
4	DTR:Data Terminal Ready	Data terminal ready
5	GND:Ground	Signal ground
6	DSR:Data set Ready	Data set ready
7	RTS:Request To Send	Request signal for sending
8	CTS:Clear To Send	Clear signal for sending
9	CI:	N.C

Data format

Transmission messages between Spectrum Analyzer and the controller are character string of ASCII code and the end of the messages is carriage return (CR) and line feed (LF).

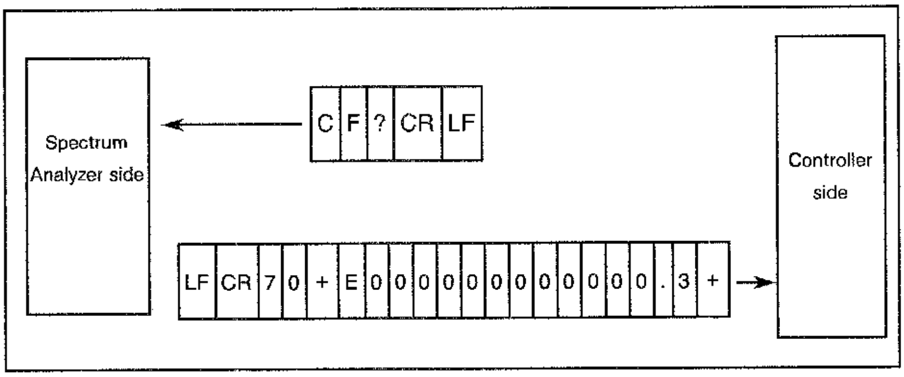


Figure 8-6 Data format

Note

1. Specify ASCII code for the transmission data.
2. Delimit the data from the controller with CR or CR and LF. Query data and the delimiter of GPIB are the same. Therefore, send DL0 or DL3 after serial port was opened. (refer to the example of RS-232C remote program.)

● **Example of data transmission**

Both CF 30.0MZ CR and CF 30.0MZ CR LF from PC can be recognized.

Query data format becomes +3.000000000000E+07 CR LF. (Send DL0 or DL3.)
The output data of this RS232C and GPIB are the same number of characters except delimiters (CR and LF).

Different points between RS-232C and GPIB

● **Command code**

- Input and output of the trace data cannot be carried out.
  Moreover, delimited data with delimiter and these plural data is not available to read.

Note
Not available commands : TAA, TBA, TAB, TBB

- SRQ interrupt cannot be used.
  Use read out command of the status bytes.

Note
Not available commands : S0, S1, S2, RQS

Panel control

Spectrum analyzer becomes following status while the remote control is carried out.

- Remote lamp dose not light.
- Key lock is not carried out. If setup is changed by the key operation during remote control then remote control becomes instability occasionally.

Example of the remote control

In this examples are using by the function of the remote control in the actual program.
Described program examples in this subchapter are written in the "Microsoft Quick Basic" licensed by Microsoft Corporation.
The Spectrum Analyzer does not have a capability of the serial line control for RS-232C, therefore, if the input statement (PRINT statement) are continuously written then the correct operation is not carried out occasionally such as input operation carried out until the end of program or wait for input (INPUT statement).
Do not exceed 1024 characters for the total number of input statement. (Refer to the input of the limit line.)
The open command of OPEN "COM1:9600, N, 8,1, ASC" FOR RANDOM AS #1 in the example program is the following contents.
Baud rate is 9600bps, no parity, 8 bits data length, stop bit of one bit, ASCII format and random access mode.

Example 1 : Read out for peak list

```
OPEN "COM1:9600,N,8,1,ASC" FOR RANDOM AS #1
PRINT #1, "DL3"          '  CR and LF are set for GPIB delimiter
PRINT #1, "CF 30MZ"      '  Center frequency of 30MHz is set
PRINT #1, "PLS LEVEL"    '  Level is specified for the peak list
PRINT #1, "TS"           '  Execution of the single sweep
PRINT #1, "PKLIST?"      '  Read out of the peak list
INPUT #1, C, F1, L1, F2, L2, F3, L3, F4, L4, F5, L5, F6, L6, F7, L7,
F8, L8, F9, L9, F10, L10, Delf, Dell
PRINT C, F1, L1, F2, L2, F3, L3, F4, L4, F5, L5, F6, L6, F7, L7, F8,
L8, F9, L9, F10, L10, Delf, Dell
END
```

Example 2 : Waiting for the sweep completion by status bytes

```
OPEN "COM1:9600,N,8,1,ASC" FOR RANDOM AS #1
PRINT #1, "DL3"   '  CR and LF are set for GPIB delimiter
PRINT #1, "SI"    '  Execution of the single sweep
PRINT #1, "OPR8"  '  Sweep completion bit in the operation register of GPIB is set
PRINT #1, "CLS"   '  Clear for status bytes
PRINT #1, "TS"    '  Execution of the single sweep
MEAS.LOOP
PRINT #1, "*STB?"'   Read our status bytes
INPUT #1, STAT
IF (STAT AND 128) = 0 THEN GOTO MEAS.LOOP
PRINT #1, "PS"    '  Peak search
PRINT #1, "ML?"   '  Read out peak level
INPUT #1, MLEVEL
PRINT MLEVEL
END
```

Error message

Following are error messages for the remote control.

- input buffer is overflow
- SIO port is busy

● input buffer is overflow

If total input characters exceeds 1024 characters then this is displayed.

(1 of 2)

Example 1 : Input of limit line

```
OPEN "COM1:9600,N,8,1,ASC" FOR RANDOM AS #1
PRINT #1, "IP"
PRINT #1, "DL3"
PRINT #1, "LMTADEL"
PRINT #1, "UU"
'
PRINT #1, "LMTAIN 500.123KZ, 70.52DB"
PRINT #1, "LMTAIN 5.432112MZ, 70.52DB"
PRINT #1, "LMTAIN 5.432112MZ, 55.57DB"
PRINT #1, "LMTAIN 10.012345MZ, 55.57DB"
PRINT #1, "LMTAIN 10.012345MZ, 43.25DB"
PRINT #1, "LMTAIN 15.012345MZ, 43.25DB"
PRINT #1, "LMTAIN 15.012345MZ, 30.25DB"
PRINT #1, "LMTAIN 20.987654MZ, 30.25DB"
PRINT #1, "LMTAIN 20.987654MZ, 51.51DB"
PRINT #1, "LMTAIN 25.123456MZ, 51.51DB"
PRINT #1, "LMTAIN 25.123456MZ, 20.38DB"
PRINT #1, "LMTAIN 30.123456MZ, 20.38DB"
PRINT #1, "LMTAIN 30.123456MZ, 32.38DB"
PRINT #1, "LMTAIN 35.456789MZ, 32.38DB"
PRINT #1, "LMTAIN 35.456789MZ, 35.55DB"
PRINT #1, "LMTAIN 40.345678MZ, 35.55DB"
PRINT #1, "LMTAIN 40.345678MZ, 40.62DB"
PRINT #1, "LMTAIN 45.345678MZ, 40.62DB"
PRINT #1, "LMTAIN 45.345678MZ, 45.62DB"
PRINT #1, "LMTAIN 50.345678MZ, 45.62DB"
PRINT #1, "LMTAIN 50.345678MZ, 51.62DB"
PRINT #1, "LMTAIN 55.654321MZ, 51.62DB"
PRINT #1, "LMTAIN 55.654321MZ, 54.35DB"
PRINT #1, "LMTAIN 65.345678MZ, 54.35DB"
PRINT #1, "LMTAIN 65.345678MZ, 57.08DB"
PRINT #1, "LMTAIN 70.987654MZ, 57.08DB"
PRINT #1, "LMTAIN 70.987654MZ, 60.52DB"
PRINT #1, "LMTAIN 75.765432MZ, 60.52DB"
PRINT #1, "LMTAIN 75.765432MZ, 62.31DB"
PRINT #1, "LMTAIN 80.123456MZ, 62.31DB"
```

(2 of 2)

```
PRINT #1, "LMTAIN 80.123456MZ, 63.54DB"
PRINT #1, "LMTAIN 85.234567MZ, 63.54DB"
PRINT #1, "LMTAIN 85.234567MZ, 68.45DB"
PRINT #1, "LMTAIN 90.765432MZ, 68.45DB"
PRINT #1, "LMTAIN 90.765432MZ, 70.05DB"
PRINT #1, "LMTAIN 95.456789MZ, 70.05DB"  ' Inputs are carried out until this line and
PRINT #1, "LMTAIN 95.456789MZ, 81.29DB"  ' exceeds 1024 characters in the line
PRINT #1, "LMTAIN 100MZ, 81.29DB"
'
PRINT #1, "FA0MZ FB100MZ"
PRINT #1, "LAN"
END
```

If the dummy INPUT statements are inserted such as following example then all of above mentioned command can be input.

(1 of 2)

Example 2 : Input of limit line

```
OPEN "COM1:9600,N,8,1,ASC" FOR RANDOM AS #1
PRINT #1, "IP"
PRINT #1, "DL3"
PRINT #1, "LMTADEL"
PRINT #1, "UU"
'
PRINT #1, "LMTAIN 500.123KZ, 70.52DB"
PRINT #1, "LMTAIN 5.432112MZ, 70.52DB"
PRINT #1, "LMTAIN 5.432112MZ, 55.57DB"
PRINT #1, "LMTAIN 10.012345MZ, 55.57DB"
PRINT #1, "LMTAIN 10.012345MZ, 43.25DB"
PRINT #1, "LMTAIN 15.012345MZ, 43.25DB"
PRINT #1, "LMTAIN 15.012345MZ, 30.25DB"
PRINT #1, "LMTAIN 20.987654MZ, 30.25DB"
PRINT #1, "LMTAIN 20.987654MZ, 51.51DB"
PRINT #1, "LMTAIN 25.123456MZ, 51.51DB"
'
PRINT #1, "LIMTYP?"                 'Dummy query command
INPUT #1, A$                        'Dummy INPUT statement
'
PRINT #1, "LMTAIN 25.123456MZ, 20.38DB"
PRINT #1, "LMTAIN 30.123456MZ, 20.38DB"
PRINT #1, "LMTAIN 30.123456MZ, 32.38DB"
PRINT #1, "LMTAIN 35.456789MZ, 32.38DB"
PRINT #1, "LMTAIN 35.456789MZ, 35.55DB"
PRINT #1, "LMTAIN 40.345678MZ, 35.55DB"
PRINT #1, "LMTAIN 40.345678MZ, 40.62DB"
PRINT #1, "LMTAIN 45.345678MZ, 40.62DB"
```

(2 of 2)

```
PRINT #1, "LMTAIN 45.345678MZ, 45.62DB"
PRINT #1, "LMTAIN 50.345678MZ, 45.62DB"
'
PRINT #1, "LIMTYP?"                          'Dummy query command
INPUT #1, A$                                 'Dummy INPUT statement
'
PRINT #1, "LMTAIN 50.345678MZ, 51.62DB"
PRINT #1, "LMTAIN 55.654321MZ, 51.62DB"
PRINT #1, "LMTAIN 55.654321MZ, 54.35DB"
PRINT #1, "LMTAIN 65.345678MZ, 54.35DB"
PRINT #1, "LMTAIN 65.345678MZ, 57.08DB"
PRINT #1, "LMTAIN 70.987654MZ, 57.08DB"
PRINT #1, "LMTAIN 70.987654MZ, 60.52DB"
PRINT #1, "LMTAIN 75.765432MZ, 60.52DB"
PRINT #1, "LMTAIN 75.765432MZ, 62.31DB"
PRINT #1, "LMTAIN 80.123456MZ, 62.31DB"

PRINT #1, "LIMTYP?"                          'Dummy query command
INPUT #1, A$                                 'Dummy INPUT statement
'
PRINT #1, "LMTAIN 80.123456MZ, 63.54DB"
PRINT #1, "LMTAIN 85.234567MZ, 63.54DB"
PRINT #1, "LMTAIN 85.234567MZ, 68.45DB"
PRINT #1, "LMTAIN 90.765432MZ, 68.45DB"
PRINT #1, "LMTAIN 90.765432MZ, 70.05DB"
PRINT #1, "LMTAIN 95.456789MZ, 70.05DB"
PRINT #1, "LMTAIN 95.456789MZ, 81.29DB"
PRINT #1, "LMTAIN 100MZ, 81.29DB"
'
PRINT #1, "FA0MZ FB100MZ"
PRINT #1, "LAN"
END
```

- **SIO port is busy**

If the serial port is used for two or more functions then this message is displayed.

Change for other options

The remote control is not available for the parallel operation with the following options which uses the serial port.
(refer to the activation of the remote control.)

- OPT08
- OUTPUT32 of OPT15 serial port.

Note

OPT08 is an option only for R3465 and R3463.

CHAPTER 9

In Abnormalities

Read this chapter when the instrument operates abnormal.

CONTENTS

1. Inspection and Simple Troubleshooting . . . 9-2

1. Inspection and Simple Troubleshooting

If the instrument does not operate properly, check the following items before asking for repair. When the trouble cannot be removed by the following countermeasures, contact the Sales and Support Offices or a nearby ADVANTEST office. Their address and phone number are attached at the end of this manual.

Symptom	Assumed cause	Remedy
The power cannot be turned on.	Power cable is not surely inserted in the connector.	Turn the power switch OFF, and re-connect the power cable.
	Power fuse is blown.	Replace power fuse.
SWEEP LED lighting up, but no waveform appears on the screen.	INTENSITY is too low.	Adjust by turning the INTENSITY control.
	Input cable or connector is loose.	Reconnect the input cable or connector.
Does not sweep	SINGLE SWEEP Mode	Set to REPEAT.
Inaccurate signal level	AMPTD CAL is not adjusted.	Execute calibration.
Key does not work.	In GPIB remote control mode	When a program is being executed, stop it and press LCL key.
Data cannot be read (recalled) from a memory card.	Defective memory card	Check operation with other memory card.
	Defective drive slot	Contact ADVANTEST and ask for repair.
Data cannot be recorded (saved) in memory card.	Write protection is enabled.	Disable write protection of the memory card.
	The memory card is not initialized.	Initialize the memory card.
	Capacity of the memory card is too small.	Use other memory card.
	Battery of the memory card is down.	Replace battery.

CHAPTER 10

OPERATION DESCRIPTION

This chapter explains basic operation of each block of this instrument.

CONTENTS

1. Description of Operations 10-2
2. Block Diagram 10-4

1. Description of Operations

The R3272 mixes the input signal with a 21.4 MHz intermediate frequency (IF) signal. (The input signal must be in the range from 9 kHz to 26.5 GHz.) The signal is then filtered with a variable-resolution bandwidth 21.4 MHz IF filter. The detector(DET) detects the signal, and the signal is digitized and displayed on the screen.

■ Mixer Section

● Input Frequencies from 9 kHz to 3.1 GHz

In the range from 9 kHz to 3.1 GHz, the input signal is fed through the input attenuator (which can attenuate 0 to 70 dB in 10 dB steps) and into the first mixer. The signal then mixes with the local oscillator signal, which is synthesized by the YIG tuning oscillator operating at 4.2 GHz to 7.8 GHz. This creates the first IF signal with a frequency of 4231.4 MHz.

The first IF signal passes through the low noise amplifier (LNA), then to the band pass filter (BPF) to eliminate spurious signals generated by the first and second mixers.

From the band pass filter, the signal passes to the second mixer. There it mixes with a 3810 MHz signal from a phase-locked second local oscillator, and converts into the second IF signal with a frequency of 421.4 MHz.

● Input Frequencies 3.0 GHz and Above

In the range of 3.0 GHz and above, the signal passes through the input attenuator to the tracking filter (a YIG tuning filter), which operates synchronously with the spectrum analyzer tuning frequency. This eliminates images and multiple response from the signal before the signal is fed into the first mixer.

The signal then passes into the first mixer and mixes with the synthesized partial oscillation signal of 3.9 GHz to 8 GHz . This creates the 421.4 MHz IF signal.

This 421.4 MHz IF signal then passes through a bandpass filter (to eliminate the image generated by the third mixer) and on to the third mixer, where it mixes with the local oscillator signal of 400 MHz to create the IF signal of 21.4 MHz. (The third local oscillator signal of 400 MHz is generated by doubling the signal from the 200 MHz oscillator, which is phase-locked to the 10 MHz reference oscillator.)

IF Section

The 21.4 MHz signal from the mixer section is fed into the IF filter, which has a variable resolution bandwidth from 300 Hz to 3 MHz. The IF section contains a step amplifier (with a 0.1 dB step) to determine the reference level.
The bandwidth filter consists of four stages of 21.4 MHz LC filters, and has a resolution of 300 kHz to 3 MHz. In the range from 100 kHz to 300 Hz, the 21.4 MHz signal is converted to a frequency of 3.58 MHz and fed through the next IF filter. (The 1 kHz and 300 Hz IF filter consists of four stages of crystal oscillators.) The signal is then converted back to a frequency of 21.4 MHz.

LOG A/D Section

In "dB" display mode, signal passes through the LOG amplifier having 100 dB dynamic range after determined resolution bandwidth by IF unit. In linear display mode signal passes through a linear amplifier to enter a detector (DET). The detected signal is converted into digital signal by A/D converter. And the digitized signal is controlled by the display unit to be displayed on a TFT LCD.

2. Block Diagram

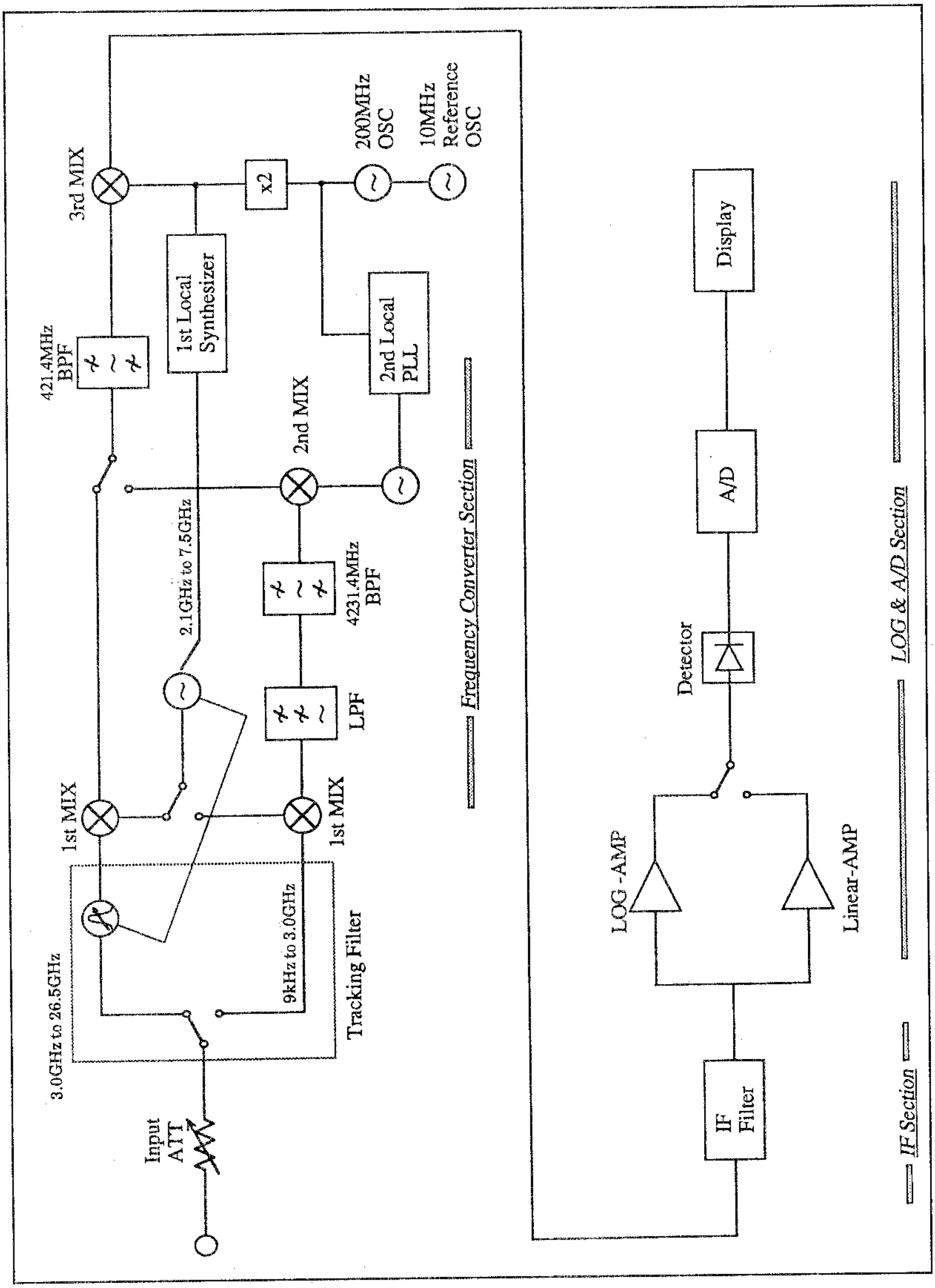


Figure 10-1 Block Diagram

CHAPTER 11

SPECIFICATIONS

This chapter shows specifications for each component of this instrument.

CONTENTS

1. R3272 Specifications 11-2

1. R3272 Specifications

■ Measurement Function

Spectrum, OBW, ACP, Harm

■ Frequency Characteristics

● **Frequency range**

9 kHz to 26.5 GHz
18 GHz to 60 GHz (With external mixer. Tunable up to 325 GHz)

Frequency range	Frequency band	Harmonic mode(N)
9 kHz to 3.1 GHz	0	1
3.0 GHz to 7.5 GHz	1	1
7.4 GHz to 15.4 GHz	2	2
15.2 GHz to 23.3 GHz	3	3
23.0 GHz to 26.5 GHz	4	4

● **Frequency read accuracy**

(Start, Stop, Center frequency, Marker frequency)

±(Frequency reading × Frequency reference accuracy + Span × Span accuracy + 0.15 × Resolution bandwidth + 10 Hz)

● **Marker frequency counter**

Resolution: 1 Hz to 1 kHz
Accuracy (S/N ≧ 25 dB): ±(Marker frequency × Frequency reference accuracy + 5 Hz × N + 1 LSD)
※ LSD : Least Significant Digit

● **Frequency reference accuracy**

$\pm 2 \times 10^{-8}$ /Day
$\pm 1 \times 10^{-7}$ /Year

● **Frequency stability**

Residual FM (Zero span): < 3Hz × $N_{P\text{-}P}$ /0.1sec
Drift: Span ≦ 5 MHz, < 20Hz × [Sweep speed(min) × N]
(After 1 hour warm-up)

● **Signal purity noise side band**

Offset	f≦3GHz	f>3GHz
10 kHz	< -100 dBc/Hz	< (-98 + 20 log N) dBc/Hz
100 kHz	< -110 dBc/Hz	< (-108 + 20 log N) dBc/Hz

● **Frequency span**

Linear span

Range: 2 kHz to 26.5 GHz, Zero span
Accuracy: ±4 % (Span > 5 MHz)
±1 % (Span ≦ 5 MHz)

- **Resolution bandwidth (3dB)**

Range	300 Hz to 3 MHz, 5 MHz (1, 3, 10 sequence)
Accuracy	±20 % (Resolution bandwidth 1 kHz to 1 MHz) ±30 % (Resolution bandwidth 300 Hz, 3 MHz, 5 MHz)
Selectivity	< 15:1 (300 Hz to 5 MHz)

- **Video bandwidth**

Range	1 Hz to 3 MHz, 5 MHz (1, 3, 10 sequence)

- **Frequency Sweep**

Sweep time	50 ms to 1000s
Accuracy	±5 %
Sweep trigger	Free run, Line, Single, Video, External
Trace / sec	10 times

Amplitude Range

- **Measurement range** +30 dBm to Average indicated noise level

- **Maximum safe input**

Average continuous power	±30dBm (1W) (Input ATT≧10 dB)
DC input	0 V

- **Display range** 10 × 10 Div

Logarithmic	10, 5, 2, 1, 0.5 dB/Div
Linear	(10% of the reference level)/Div

- **Reference level range**

Logarithmic	-105 dBm to +60 dBm (0.1 dB step)
Linear	1.25μ V to 223 V (approx. 1 % step of the full scale)

- **Input attenuator range** 0 to 70 dB (10 dB step)

Dynamic Range

- **Average display noise level**

Frequency range	Frequency band	Noise level
10 kHz	0	-70 dBm
100 kHz	0	-80dBm
1 MHz to 3.1 GHz	0	-{115-1.55×f(GHz)} dBm
3.0 GHz to 7.5 GHz	1	-110 dBm
7.4 GHz to 15.4 GHz	2	-103 dBm
15.2 GHz to 23.3 GHz	3	-96 dBm
23.0 GHz to 26.5 GHz	4	-90 dBm

(Resolution bandwidth : 1 kHz, Input attenuator : 0dB, Video bandwidth : 1 Hz)

- **1dB gain compression**

Frequency range	Mixer input level
>10 MHz	-5 dBm

- **Spurious response**

Second harmonic distortion

Frequency range	Second harmonic distortion	Mixer level
10 MHz to 3.0 GHz > 3.0 GHz	<-70 dBc <-100 dBc	-30 dBm -10 dBm

Third-Order intermodulation distortion

Frequency range	Third-Order intermodulation distortion	Mixer level
10 MHz to 3.0 GHz > 3.0 GHz	<-75 dBc <-75 dBc	-30 dBm -30 dBm

(12.5 kHz Separation, Resolution bandwidth : 300 Hz)

Image/Multiple/Out-of-Band response

Frequency range	Image/Multiple/Out-of-Band response
10 MHz to 18 GHz 10 MHz to 23 GHz 10 MHz to 26.5 GHz	<-70 dBc <-60 dBc <-50 dBc

Residual response

Frequency range	Residual response
1 MHz to 3.0 GHz 300 kHz to 26.5 GHz	<-100 dBm <-90 dBm

(No input signal, Input ATT 0dB, 50Ω terminate)

Amplitude Accuracy

- **Frequency response**

Flatness within the band

Frequency range	Flatness within the band	Frequency band
1 kHz to 3.1 GHz	±1.5 dB	0
50 MHz to 3.1 GHz	±1.0 dB	0
3.0 GHz to 7.5 GHz	±1.5 dB	1
7.4 GHz to 15.4 GHz	±3.5 dB	2
15.4 GHz to 23.3 GHz	±4.0 dB	3
23.0 GHz to 26.5 GHz	±4.0 dB	4

(Input ATT 10dB)

Additional error due to band switching

Frequency range	Additional error
9 kHz to 26.5 GHz	±5 dB

(Calibration signal as the reference)

- **Calibration signal accuracy(30 MHz)**

-10 dBm ±0.3 dBm

- **IF gain error (After self-calibration)**

	Temperature range	IF gain error
0 dBm to -50 dBm	15 °C to 35 °C	±0.5 dB
	0 °C to 50 °C	±0.6 dB

- **Scale indication accuracy (After self calibration)**

Temperature range	Logarithmic	Linear
15 °C to 35 °C	±0.2 dB/1 dB ±1 dB/10 dB ±1.5 dB/80 dB	±15% of reference level (Within 8 Div)
0 °C to 50 °C	±0.3 dB/1 dB ±1.2 dB/10 dB ±1.5 dB/80 dB	±20% of reference level (Within 8 Div)

- **Input attenuator switching error**

Frequency range	switching error
0 Hz to 12.4 GHz	±1.1 dB / 10 dB Step, Max. 2.0 dB
12.4 GHz to 18.0 GHz	±1.3 dB / 10 dB Step, Max. 2.5 dB
18.0 GHz to 26.5 GHz	±1.8 dB / 10 dB Step, Max. 3.5 dB

(10 dB as the reference ; at 20 to 70 dB)

- **Resolution bandwidth switching error**

Temperature range	switching error
15 °C to 35 °C	≦±0.3 dB
0 °C to 50 °C	≦±0.5 dB

(Resolution bandwidth: 300 kHz reference, after self-calibration, 3×Resolution bandwidth≧Span, 300 Hz to 3 MHz)

- **Pulse quantization error** — (In pulse measurement mode, PRF > 500/Sweep time)
  - Logarithmic — 1.2 dB (Resolution bandwidth≦1 MHz)
    3 dB (Resolution bandwidth = 3 MHz)
  - Linear — 4% of the reference level (Resolution bandwidth≦1 MHz)
    12% of the reference level (Resolution bandwidth = 3 MHz)

Analog Demodulation

- **Spectrum demodulation**
  - Modulation type — AM, FM
  - Audio output — Internal speaker, earphone jack, sound volume adjustable
  - Demodulation duration — 100ms to 1000s

Input/Output

- **RF input**
  - Connector — N-type female(Can be converted to SMA type.), Front Panel
  - Impedance — 50 Ω (nominal)
  - VSWR — (Frequency setting input ATT≧10 dB)
    < 1.5 : 1 (≦3 GHz) (nominal)
    < 2.5 : 1 (> 3 GHz) (nominal)

- **1st LO output**
  - Connector — SMA female, Front panel
  - Impedance — 50 Ω (nominal)
  - Frequency — 3.421 MHz to 7.921 GHz
  - Amplitude — > +5 dBm

- **Calibration signal output**

Connector	BNC female, Front panel
Frequency	30 MHz × (1 ± Frequency reference accuracy)
Impedance	50 Ω (nominal)
Amplitude	-10 dBm ± 0.3 dB

- **10MHz frequency reference input/output**

Connector	BNC female, Rear panel
Output impedance	50 Ω (nominal)
Output frequency accuracy	10MHz × Frequency reference accuracy
Input/output amplitude range	-5 dBm to +5 dBm

- **21.4MHz IF output**

Connector	BNC female, Rear panel
Impedance	50 Ω (nominal)

- **421MHz IF output**

Connector	BNC female, Rear panel
Impedance	50 Ω (nominal)

- **Video output**

Connector	VGA(15 pin, female), Rear panel 640 × 480 dot VGA equivalent

- **X axis output**

Connector	BNC female, Rear panel
Impedance	1 kΩ (nominal), DC connection
Amplitude	approx. -5 V to +5 V

- **Y axis output**

Connector	BNC female, Rear panel
Impedance	220 Ω (nominal)
Amplitude	approx. 2 V in full scale (10dB/DIV) maximum approx. -3V to 5V

- **Z axis output**

Connector	BNC female, Rear panel
Amplitude	TTL level
During sweep	High level
Blanking	Low level

- **External trigger input**

Connector	BNC female, Rear panel
Impedance	10 kΩ (nominal), DC connection
Trigger level	TTL level

- **Gate input**

Connector	BNC female, Rear panel
Impedance	10 kΩ (nominal)
Sweep stop	During low mode at TTL level
Sweep	During high mode at TTL level

- **Voice output(Demodulation audio)**

Connector	Small-size monophonic jack, Front panel
Power output	Maximum 0.2 W, 8 Ω (nominal)

- **Plobe power** — 4 pin connector, Front panel

Voltage	+12.6V, -12.6V
Current	Max. 100mA each

- **I/O**

GPIB	IEEE-488, bus connector, Rear panel
RS-232	D-SUB 9 pin, Rear panel
P-I/O	D-SUB 25 pin, Rear panel
EXT-KEY	DIN, Front panel

- **Direct print** — Output with 'ESC/P' or 'HP PCL' command

- **Memory card** — 2 slots, Front panel

Connector	JEIDA-Ver 4.0 / PCMCIA 2.0 or more

- **Program loader** — Option

General Specifications

- **Temperature and humidity**

During operation	0°C to 50°C
When stored	-20°C to 60°C
Relative Humidity	85% or below

- **Power source**

During 100VAC operation	
Rated Voltage	100 V to 120 V
Power consumption	300 VA or below
Frequency	50 Hz/60 Hz
During 220VAC operation	
Rated Voltage	220 V to 240 V
Power consumption	300 VA or below
Frequency	50 Hz/60 Hz

- **Mass** — 16.5 kg or below (Excluding optional blocks, front cover, and accessories)

- **Dimensions** — Approx. 177 mm (Height) × 350 mm (Width) × 420 mm (Depth) (Excluding the handle, feet and front cover)

APPENDIX

In this appendix, you will find a glossary, a menu lists and list of messages.

CONTENTS

1. Glossary A-2
2. dB Conversion Formulas A-7
3. Menu Lists A-8
4. Restriction on the IC Card A-18
5. List of Messages A-19

1. Glossary

[B]

Bandwidth Accuracy

The bandwidth accuracy of the IF filter is expressed by the deviation from the nominal value of the 3dB-lowered point. This efficiency has almost no effect on measurement of normal signals of continuous level, but it should be taken into consideration when measuring the level of a noise signal.

Bandwidth Switching Accuracy

Several IF filters are used to obtain optimal resolution (in signal spectrum analysis) according to the scan width. When switching from one IF filter to another while measuring one and the same signal, an error is generated for the difference in loss. This error defined as the bandwidth switching accuracy.

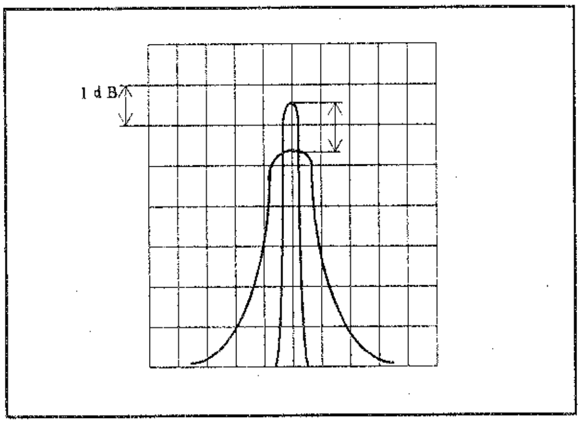


Figure A-1 Bandwidth Switching Accuracy

[E]

Electromagnetic compatibility (EMC)

The ability of a system to opetate without producing or being affected by electromagnetic interference.

Electromagnetic interference (EMI)

Electromagnetic interference (EMI) is a disturbanse in the reception of desired signals caused by unwanted electromagnetic energy, or something. EMI can be caused by any source of EM energy, such as (list a pertinent rew). Modern circuits are designed to produce as little EM energy as possible, but since the EM can not be completely eliminated. the cabinets containing EM-can not equipment are shielded to exclude EMI.

[F]

Frequency Response

This term represents amplitude characteristics (frequency characteristics) for a given frequency.
In the spectrum analyzer, frequency response means the frequency characteristics (flatness) of input attenuator and mixer for the input frequency, and is given in ±Δ dB.

[G]

Gain Compression

If the input signal is greater than a certain value, the correct value is not displayed on the CRT and the input signal appears as if it were compressed. This phenomenon is called gain compression, and is a expresses the linearity of the input signal range. Max gain compression is 1dB.

[I]

IF Bandwidth

The spectrum analyzer uses band pass filter (BPF) to analyze the frequency components contained in the input signal. The 3dB bandwidth of the BPF is called the IF band (See Figure A-2(a)).
The BPF characteristics should be set according to the sweep width and the sweep speed used for the waveform.

This spectrum analyzer sets the optimal value according to the sweep width. In general, smaller bandwidths inprove resolution. Therefore, the resolution of the spectrum analyzer can be expressed by the narrowest IF bandwidth (See Figure A-2 (b)).

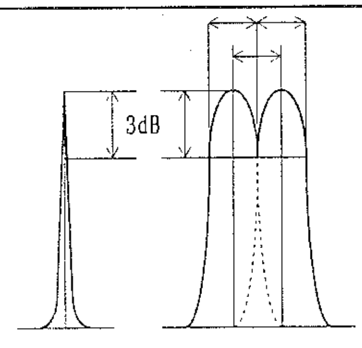


Figure A-2 IF Bandwidth

[M]

Maximum Input Level

This is the maximum level allowed for the input circuit of the spectrum analyzer. The level can be modified by the input attenuator.

Maximum Input Sensitivity

This is maximum sensitivity of the spectrum analyzer to detect signals. The sensitivity is affected by the noise generated by the spectrum analyzer itself and depends on the IF bandwidth. The maximum input sensitivity is normally expressed as the average noise level in the minimum IF bandwidth of the spectrum analyzer.

[N]

Noise Sideband

The spectrum analyzer efficiency is lowered by the noise generated in the local oscillator and phase lock loop of the analyzer itself, which will appear in the vicinity of the spectrum on the CRT.

To compensate for this, the sideband of the analyzer itself is defined so that signals out of the sideband can be analyzed in a certain range. This range is called the noise sideband.
The spectrum analyzer's noise sideband characteristics are expressed in the following example.

Example:
Suppose the IF bandwidth is 1kHz, -70dB at 20kHz apart from the carrier. The noise level is normally expressed by the energy contained in the 1Hz bandwidth. (See Figure A-3 (b).)

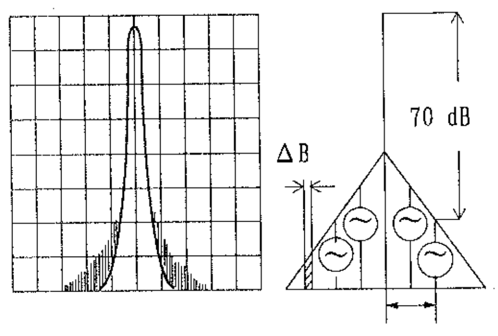


Figure A-3 Noise Sideband

If this is expressed in 1Hz bandwidth: Since the value is -70dB when the bandwidth is 1kHz, the signals within the 1Hz bandwidth will be lower than this by about 10 log 1Hz/1kHz [dB] , or about 30dB; consequently, it is expressed as -100dB/Hz at 20kHz apart from the carrier when the IF bandwidth is 1kHz.

[O]

Occupied Bandwidth

Modulation causes the frequency spectrum of an EM signal to spread significantly. The occupied bandwidth is the portion of the signals that contains 99% of the total average power radiated (See Figure A-4).

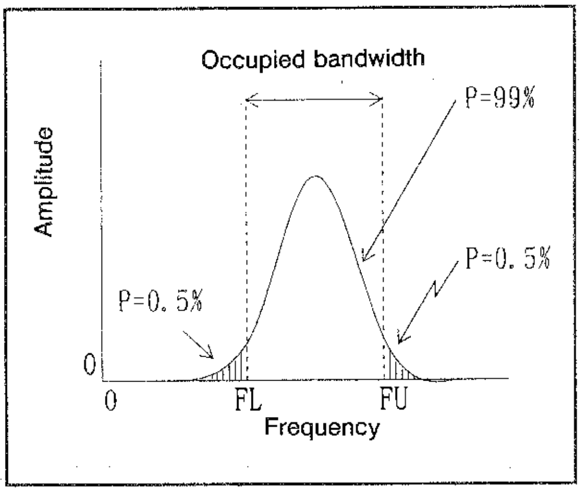


Figure A-4 Occupied Bandwidth

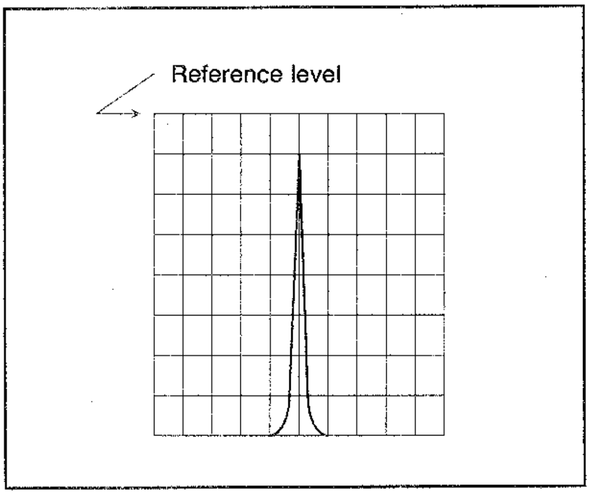


Figure A-5 Reference Level

[Q]

Quasi-Peak Value Measurements

In radio communication, EMI usually appears as an impulse. To evaluate this interference, the analyzer uses the noise power in proportion to the peak value. The measurement bandwidth and detection constant used for this evaluation are called quasi-peak value measurements,and are detarmined by JRTC specifications (in Japan) and CISPR specifications (international).

[R]

Reference Level Display Accuracy

When reading the absolute level of an input signal on the spectrum analyzer, the level is determined by the distance in dB from the uppermost scale on the screen. The level set for this uppermost scale is called reference level.
The reference level is modified by the IF GAIN key and the input attenuator, and displayed in dBm or dBμ. The absolute accuracy of this display is the reference level accuracy.

Residual FM

The short-period frequency stability of the local oscillators built in the spectrum analyzer is expressed as residual FM. The frequency width fluctuating per unit time is expressed by p-p. This also determines the measurement limit value when measuring the residual FM of the signal .

Residual Response

Residual response is a measure of how much (in the input level calculation) the spurious signal generated in the spectrum analyzer is suppressed. Residual response is generated by leaks of particular signals such as local oscillation output in the spectrum analyzer. This should be taken into consideration when analyzing a precise input signal.

Resolution Bandwidth Selectivity

The band pass filter normally attenuates Gauss distribution instead of so-called rectangular characteristics. Consequently, if two adjacent signals of different sizes are mixed, the smaller signal "hides" at the tail of the larger signal (See Figure A-6).
Therefore, the bandwidth at a certain attenuation range (60dB) should also be defined. The ratio between the 3dB width and 60dB width is expressed as the bandwidth selectivity.

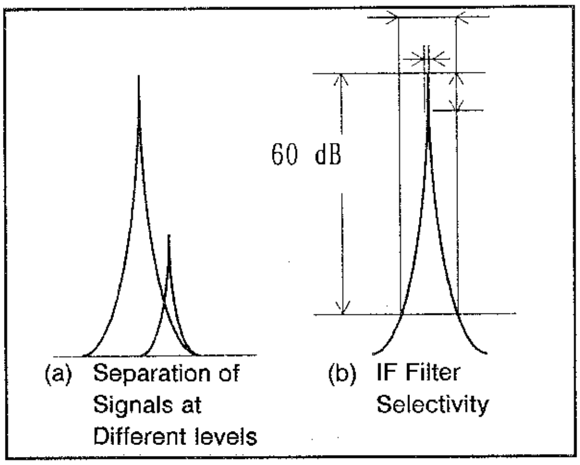


Figure A-6 Bandwidth Selectivity

[S]

Spurious Response

This is distortion caused by the higher harmonic spurious signal generated in the input mixer when the signal level is increased.
The range that can be used without distortion varies according to the input level of the basic wave. In the example shown Figure A-7 , the range is from -30dBm to -70dB. If the input signal level is too great, the input attenuator is used to decrease the signal fed to the mixer so that a proper input level can be obtained.

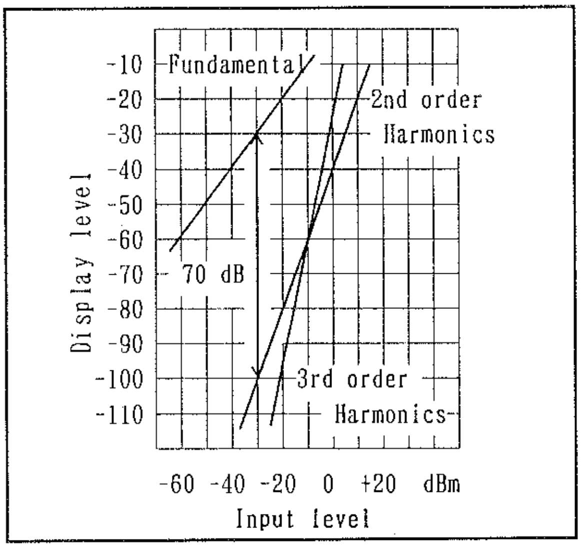


Figure A-7 Spurious Response

Spurious Signals

Spurious signals are undesired signals that can interfere with the target signal. Spurious signals can be divided into several types as follows:

Higher Harmonic spurious
This is the higher harmonic level generated by the spectrum analyzer itself (normally in the mixer circuit) when an ideal undistorted signal is fed to the analyzer. This also means the efficiency to measure higher harmonic distortion.

Adjacent spurious
This is the small spurious signal generated in the vicinity of the spectrum when a pure, single-spectrum signal is fed to the spectrum analyzer.

Non-higher Harmonic spurious
This is a spurious signal of a certain inherent frequency generated by the spectrum analyzer itself. This is also called residual response.

[V]

Voltage Standing Wave Ratio (VSWR)

This is a constant that represents the impedance matching state. It is expressed as the ratio between the maximum and minimum values in the standing wave generated as a combination of progressive wave and reflected wave in the spectrum analyzer loaded against the ideal nominal impedance source. This is a variation of reflection factor and reflection attenuation amount.
In FigureA-8 , the value of signal E_1 received at the receiver (spectrum analyzer input) is identical to that of E_0 if E_0 is transmitted to the receiver without impedance mismatching. If the signal is compretely reflected due to mismatching of the receiver and returned to the transmitter, the ratio of reflection, i. e. , the reflection factor can be expressed as follows, assuming ER as the reflected wave size:

Reflection factor Γ = Reflected wave ER / Transmitted wave E_0

Return loss (dB) = 20log ER / E_0 [dB]

$VSWR = (E_0 + ER)/(E_0 - ER)$

The relationship to the reflection factor will be:

$VSWR = (1 + |\Gamma|)/(1 - |\Gamma|)$

The VSWR will be in the range 1 to ∞. The matching state is improved as the value approaches 1.

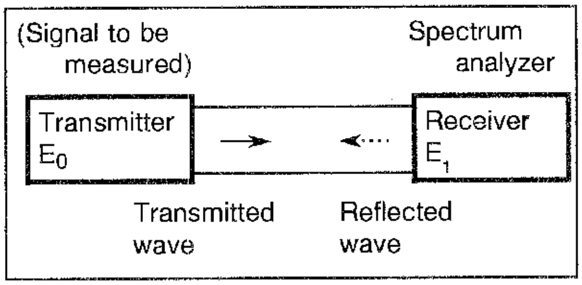


Figure A-8 VSWR

[Y]

YIG-tuned Oscillator

This was first reported by Griffiths in 1946. Garnet ferrites such as YIG (Yttrium-iron garnet) monocrystal show extremely sharp electron spin resonance in the microwave area, and has a resonance frequency in proportion to the direct-current magnetic field applied over a wide frequency range.
Therefore, YIG crystals can be used for wide-range electronic tunig, changing the current exciting the elector magnet that generates direct current magnetic field. YIG crystals are used in the local sweep generator of the spectrum analyzer and in other devices such as auto microwave frequency counters.

[Z]

Zero Span

The spectrum analyzer sweeps at any frequency along the horizontal axis as the time axis but will not sweep in zero span mode.

2. dB Conversion Formulas

Definitions

$0dBV = 1Vrms$ $\qquad$ $YdBV = 20\log\frac{XV}{1V}$

$0dBm = 1mW$ $\qquad$ $YdBm = 10\log\frac{XmW}{1mW}$

$0dB\mu V = 1\mu Vrms$ $\qquad$ $YdB\mu V = 20\log\frac{X\mu V}{1\mu V}$

$0dBpw = 1pW$ $\qquad$ $YdBpw = 10\log\frac{XpW}{1pW}$

Conversion formulas

If $R = 50\ \Omega$:
$dBV \cong (dBm - 13dB)$
$dB\mu V \cong (dBm + 107dB)$
$dB\mu Vemf \cong (dBm + 113dB)$
$dBpw \cong (dBm + 90dB)$

If $R = 75\ \Omega$:
$dBV \cong (dBm - 11dB)$
$dB\mu V \cong (dBm + 109dB)$
$dB\mu Vemf \cong (dBm + 115dB)$
$dBpw \cong (dBm + 90dB)$

Examples

Converting 1mV into dBμV: $20\log\frac{1mV}{1\mu V} = 20\log 10^3 = 60dB\mu V$

Converting 0dBm into dBμV:
$$\begin{cases} 0dBm + 107dB = 107dB\mu V(R = 50\Omega) \\ 0dBm + 109dB = 109dB\mu V(R = 75\Omega) \end{cases}$$

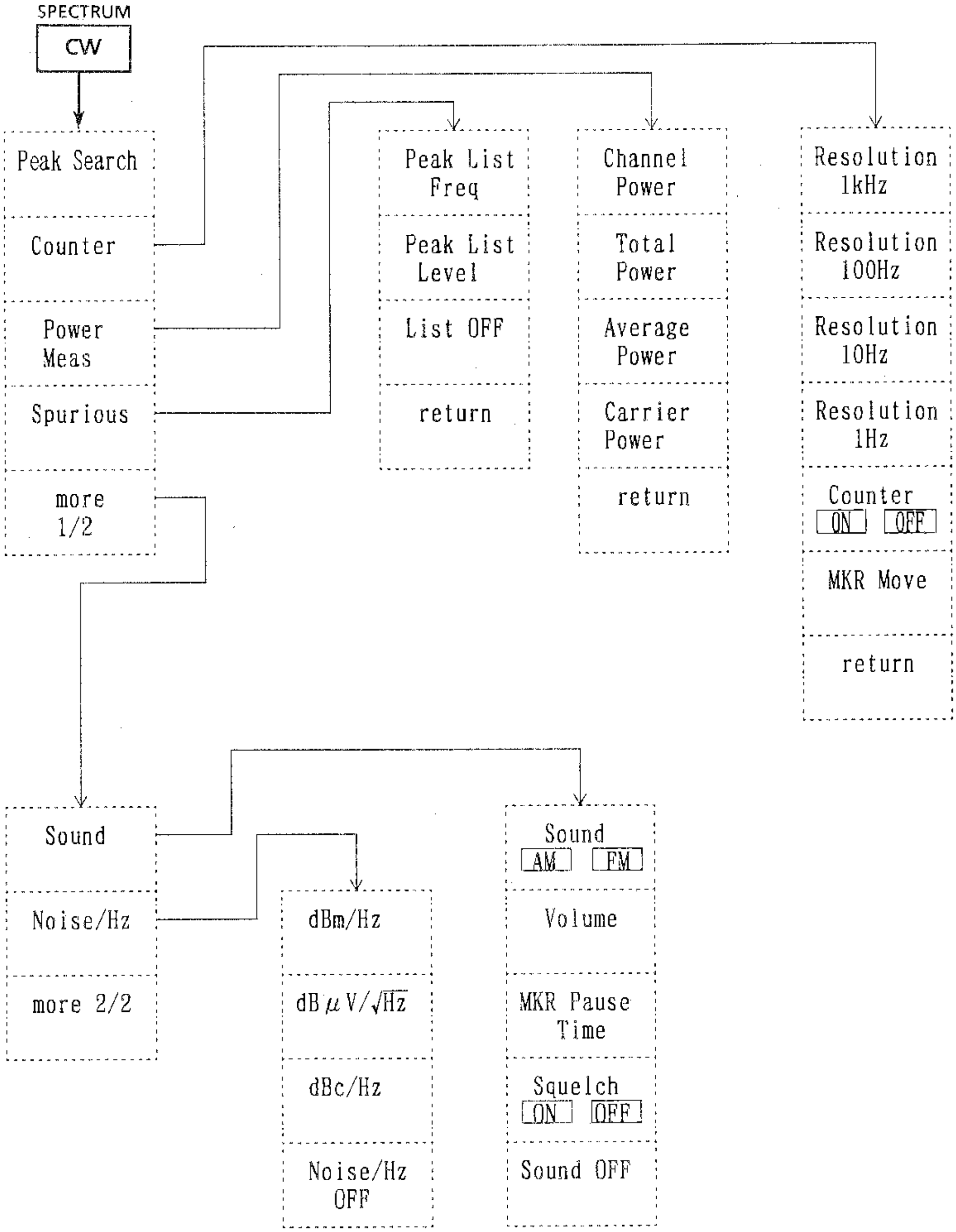
Converting 60dBμV into dBm:
$$\begin{cases} 60dB\mu V - 107dB = -47dBm(R = 50\Omega) \\ 60dB\mu V - 109dB = -49dBm(R = 75\Omega) \end{cases}$$

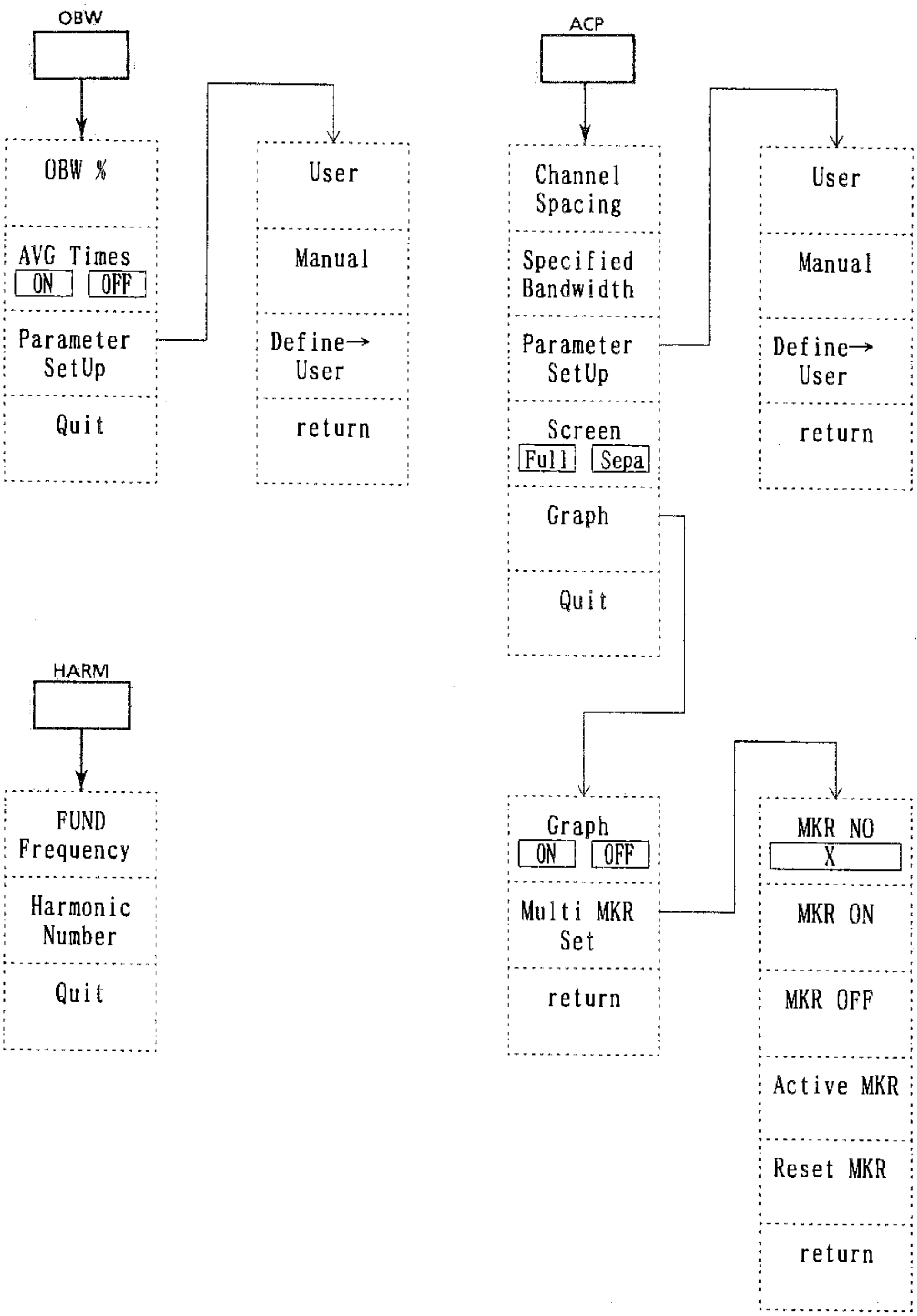
Converting 10V/m into dBμV/m: $20\log\frac{10V/m}{1\mu V/m} = 140dB\mu V/m$

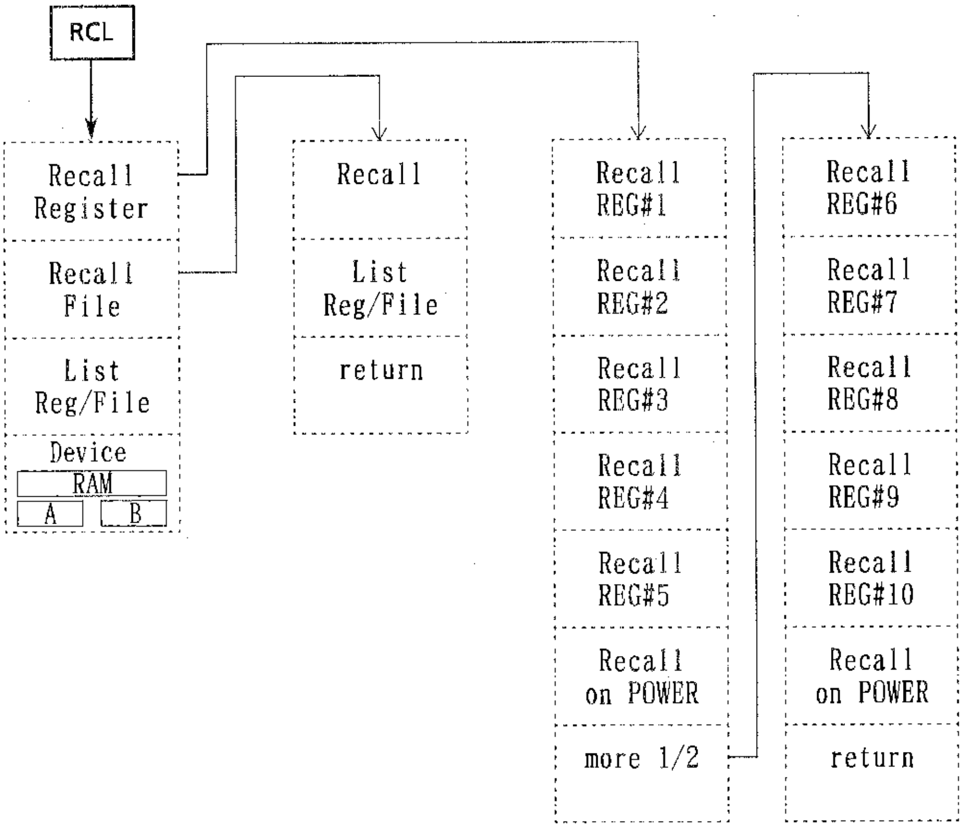
Relationship between dBm and Watt

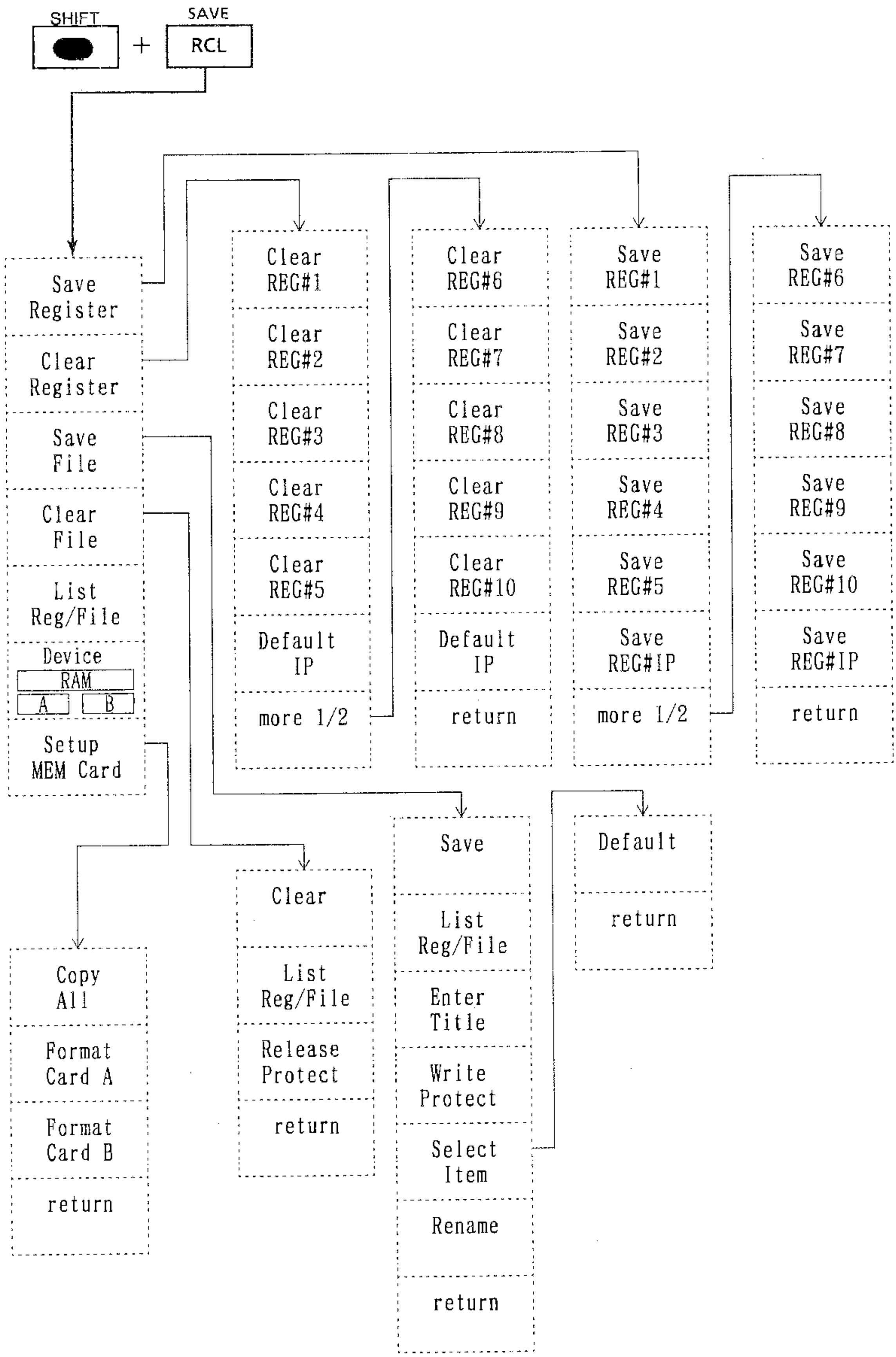
+50dBm	+40dBm	+30dBm	+20dBm	+10dBm	+0dBm	-10dBm	-20dBm	-30dBm
100W	10W	1W	100mW	10mW	1mW	0.1mW	0.01mW	0.001mW

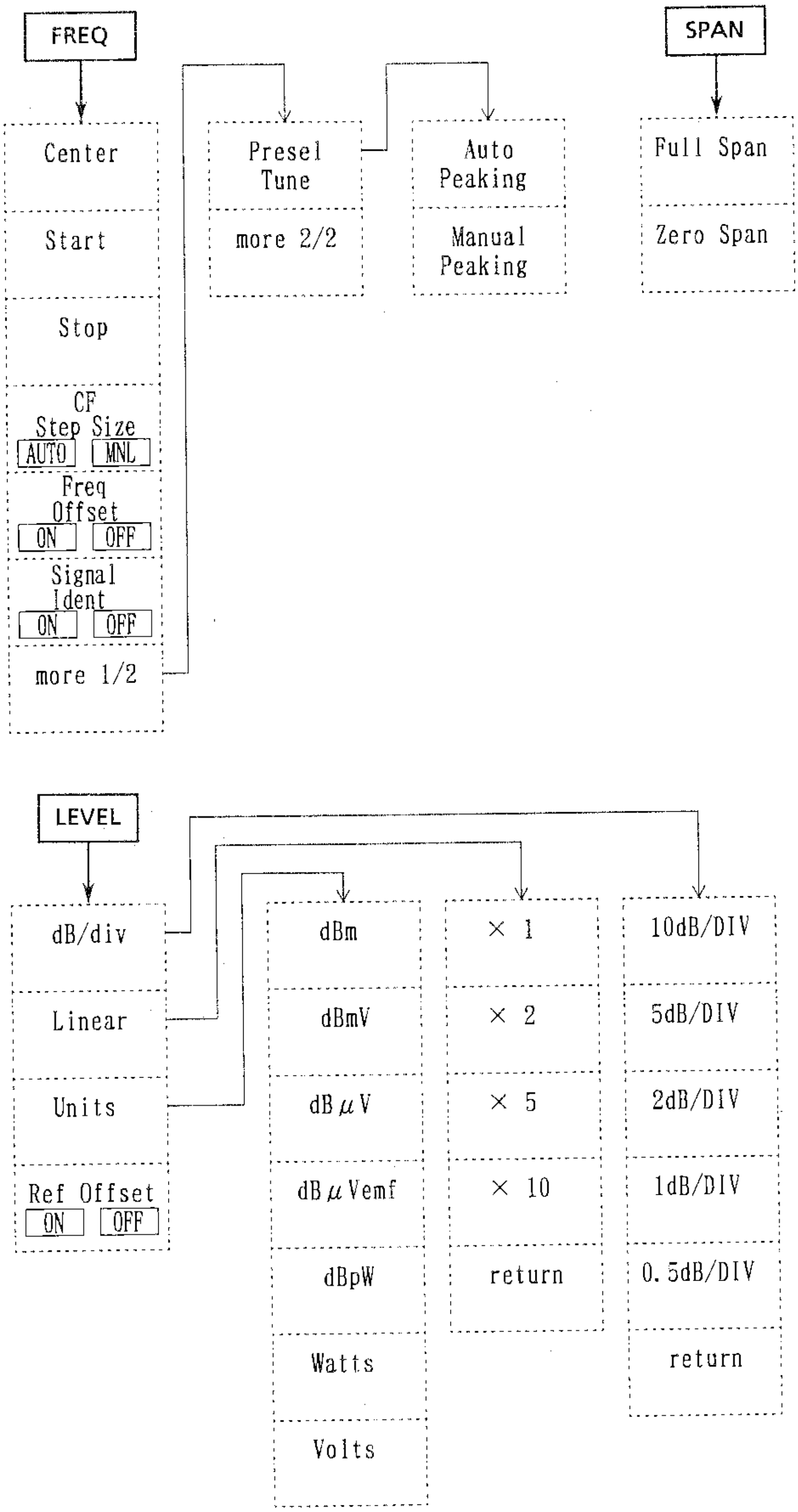
3. Menu Lists

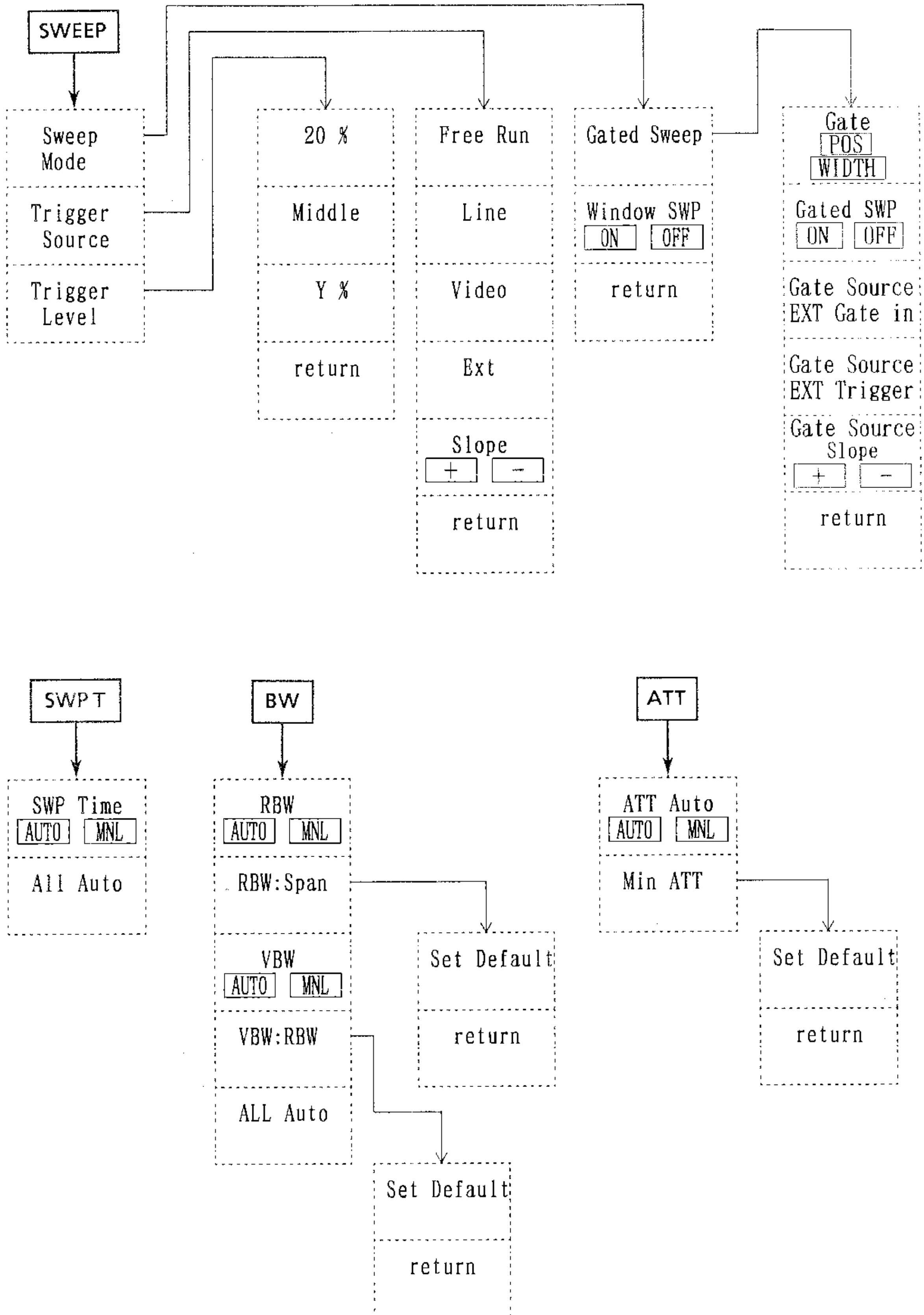

SPECTRUM
CW
Peak Search
Counter
Power Meas
Spurious
more 1/2
Peak List Freq
Peak List Level
List OFF
return
Channel Power
Total Power
Average Power
Carrier Power
return
Resolution 1kHz
Resolution 100Hz
Resolution 10Hz
Resolution 1Hz
Counter ON OFF
MKR Move
return
Sound
Noise/Hz
more 2/2
dBm/Hz
dBμV/√Hz
dBc/Hz
Noise/Hz OFF
Sound AM FM
Volume
MKR Pause Time
Squelch ON OFF
Sound OFF

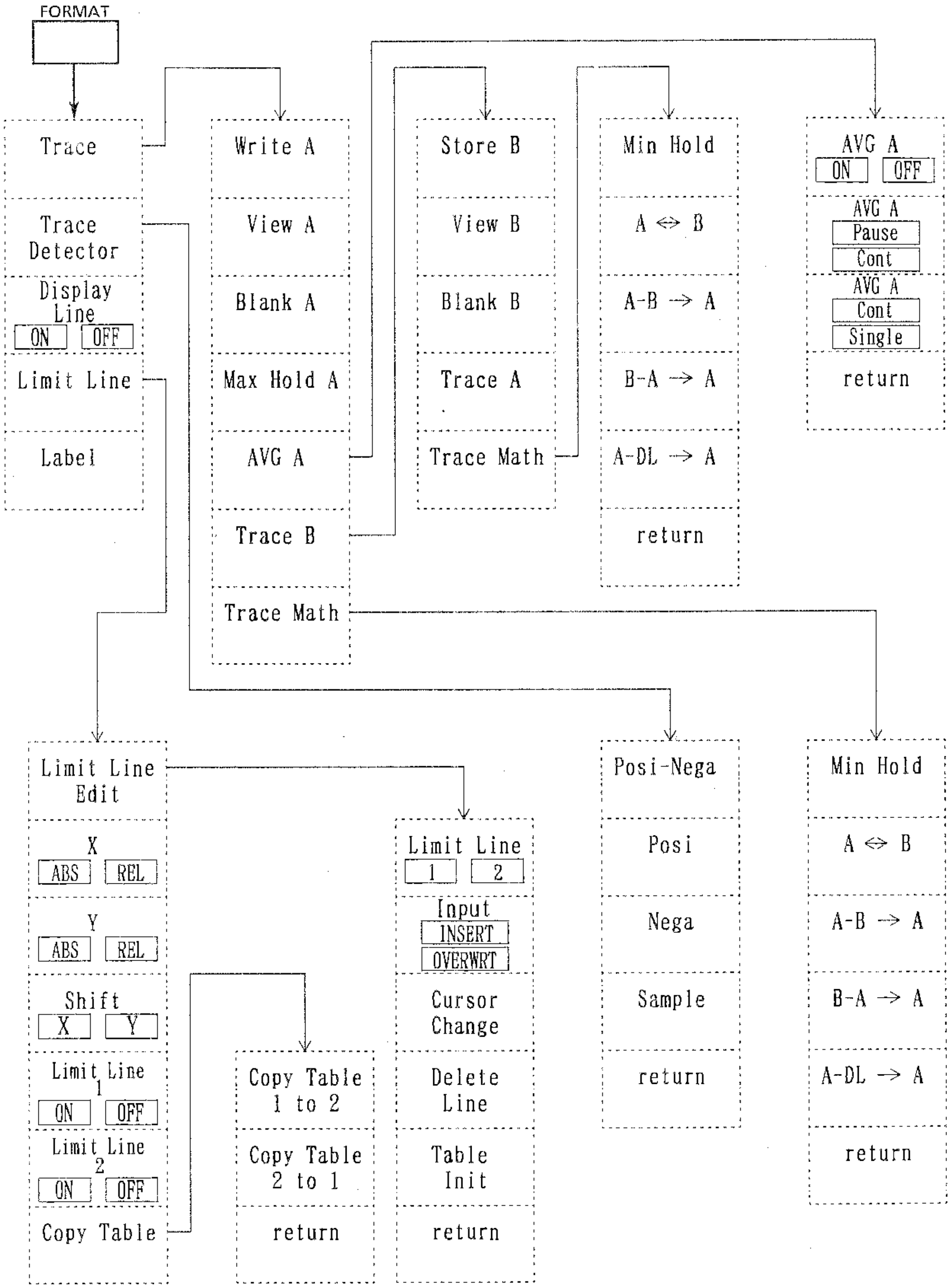

OBW
OBW %
AVG Times
ON OFF
Parameter SetUp
Quit
User
Manual
Define→ User
return
ACP
Channel Spacing
Specified Bandwidth
Parameter SetUp
Screen
Full Sepa
Graph
Quit
User
Manual
Define→ User
return
HARM
FUND Frequency
Harmonic Number
Quit
Graph
ON OFF
Multi MKR Set
return
MKR NO
X
MKR ON
MKR OFF
Active MKR
Reset MKR
return

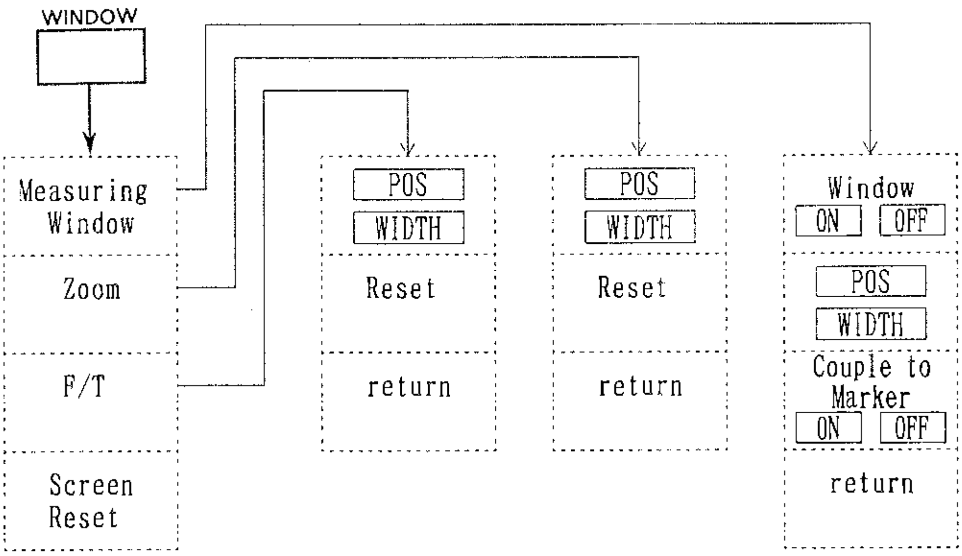

RCL
Recall Register
Recall File
List Reg/File
Device
RAM
A
B
Recall
List Reg/File
return
Recall REG#1
Recall REG#2
Recall REG#3
Recall REG#4
Recall REG#5
Recall on POWER
more 1/2
Recall REG#6
Recall REG#7
Recall REG#8
Recall REG#9
Recall REG#10
Recall on POWER
return

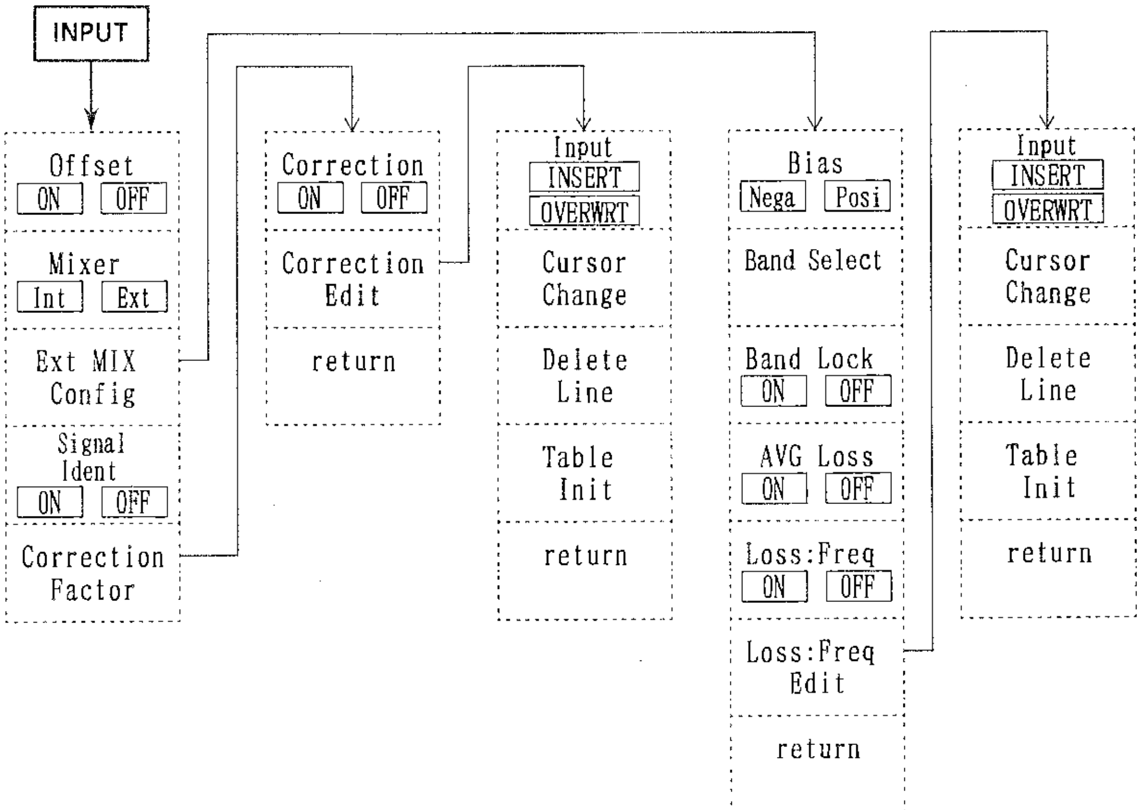

SHIFT
SAVE
RCL
Save Register
Clear Register
Save File
Clear File
List Reg/File
Device
RAM
A
B
Setup MEM Card
Clear REG#1
Clear REG#2
Clear REG#3
Clear REG#4
Clear REG#5
Default IP
more 1/2
Clear REG#6
Clear REG#7
Clear REG#8
Clear REG#9
Clear REG#10
Default IP
return
Save REG#1
Save REG#2
Save REG#3
Save REG#4
Save REG#5
Save REG#IP
more 1/2
Save REG#6
Save REG#7
Save REG#8
Save REG#9
Save REG#10
Save REG#IP
return
Save
List Reg/File
Enter Title
Write Protect
Select Item
Rename
return
Default
return
Clear
List Reg/File
Release Protect
return
Copy All
Format Card A
Format Card B
return

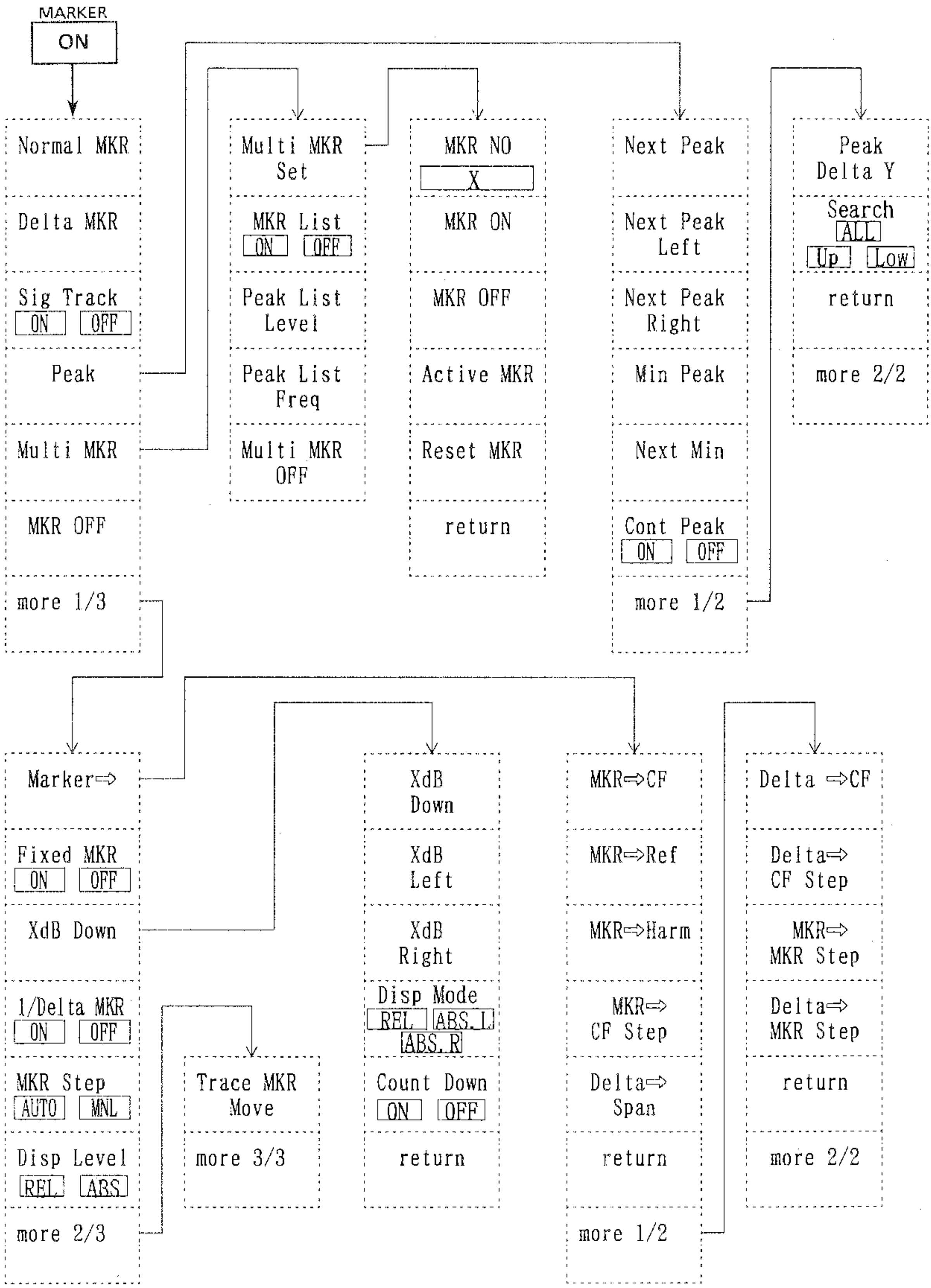

FREQ
Center
Start
Stop
CF Step Size AUTO MNL
Freq Offset ON OFF
Signal Ident ON OFF
more 1/2
Presel Tune
more 2/2
Auto Peaking
Manual Peaking
SPAN
Full Span
Zero Span
LEVEL
dB/div
Linear
Units
Ref Offset ON OFF
dBm
dBmV
dBμV
dBμVemf
dBpW
Watts
Volts
× 1
× 2
× 5
× 10
return
10dB/DIV
5dB/DIV
2dB/DIV
1dB/DIV
0.5dB/DIV
return

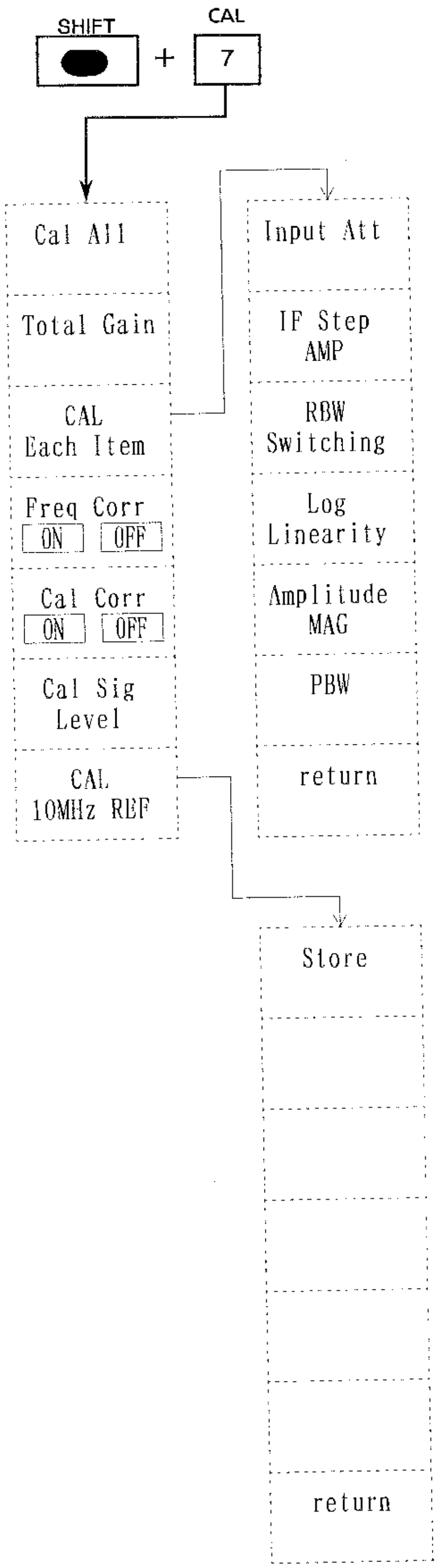

SWEEP
Sweep Mode
Trigger Source
Trigger Level
20 %
Middle
Y %
return
Free Run
Line
Video
Ext
Slope
+ -
return
Gated Sweep
Window SWP
ON OFF
return
Gate
POS
WIDTH
Gated SWP
ON OFF
Gate Source EXT Gate in
Gate Source EXT Trigger
Gate Source Slope
+ -
return
SWPT
SWP Time
AUTO MNL
All Auto
BW
RBW
AUTO MNL
RBW:Span
VBW
AUTO MNL
VBW:RBW
ALL Auto
Set Default
return
Set Default
return
ATT
ATT Auto
AUTO MNL
Min ATT
Set Default
return

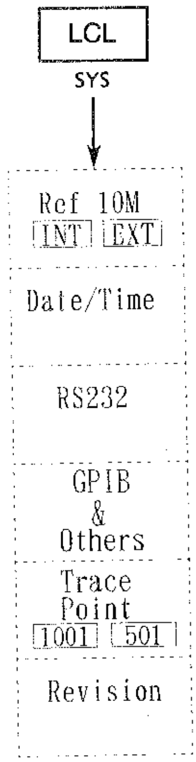

FORMAT
Trace
Trace Detector
Display Line ON OFF
Limit Line
Label
Write A
View A
Blank A
Max Hold A
AVG A
Trace B
Trace Math
Store B
View B
Blank B
Trace A
Trace Math
Min Hold
A ⇔ B
A-B → A
B-A → A
A-DL → A
return
AVG A ON OFF
AVG A Pause Cont
AVG A Cont Single
return
Limit Line Edit
X ABS REL
Y ABS REL
Shift X Y
Limit Line 1 ON OFF
Limit Line 2 ON OFF
Copy Table
Copy Table 1 to 2
Copy Table 2 to 1
return
Limit Line 1 2
Input INSERT OVERWRT
Cursor Change
Delete Line
Table Init
return
Posi-Nega
Posi
Nega
Sample
return
Min Hold
A ⇔ B
A-B → A
B-A → A
A-DL → A
return

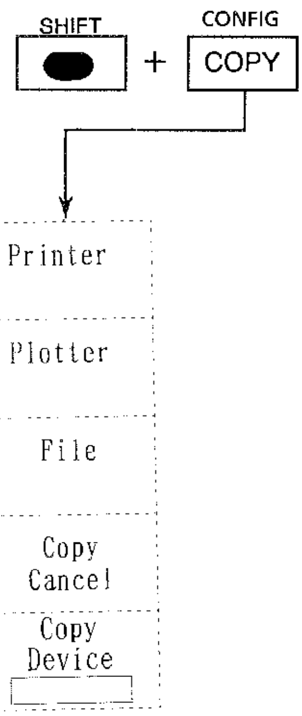

WINDOW
Measuring Window
Zoom
F/T
Screen Reset
POS
WIDTH
Reset
return
POS
WIDTH
Reset
return
Window
ON
OFF
POS
WIDTH
Couple to Marker
ON
OFF
return


INPUT
Offset
ON
OFF
Mixer
Int
Ext
Ext MIX Config
Signal Ident
ON
OFF
Correction Factor
Correction
ON
OFF
Correction Edit
return
Input
INSERT
OVERWRT
Cursor Change
Delete Line
Table Init
return
Bias
Nega
Posi
Band Select
Band Lock
ON
OFF
AVG Loss
ON
OFF
Loss:Freq
ON
OFF
Loss:Freq Edit
return
Input
INSERT
OVERWRT
Cursor Change
Delete Line
Table Init
return


MARKER
ON
Normal MKR
Delta MKR
Sig Track ON OFF
Peak
Multi MKR
MKR OFF
more 1/3
Multi MKR Set
MKR List ON OFF
Peak List Level
Peak List Freq
Multi MKR OFF
MKR NO
X
MKR ON
MKR OFF
Active MKR
Reset MKR
return
Next Peak
Next Peak Left
Next Peak Right
Min Peak
Next Min
Cont Peak ON OFF
more 1/2
Peak Delta Y
Search ALL Up Low
return
more 2/2
Marker⇒
Fixed MKR ON OFF
XdB Down
1/Delta MKR ON OFF
MKR Step AUTO MNL
Disp Level REL ABS
more 2/3
Trace MKR Move
more 3/3
XdB Down
XdB Left
XdB Right
Disp Mode REL ABS.L ABS.R
Count Down ON OFF
return
MKR⇒CF
MKR⇒Ref
MKR⇒Harm
MKR⇒ CF Step
Delta⇒ Span
return
more 1/2
Delta ⇒CF
Delta⇒ CF Step
MKR⇒ MKR Step
Delta⇒ MKR Step
return
more 2/2


SHIFT
CAL
+ 7
Cal All
Total Gain
CAL Each Item
Freq Corr ON OFF
Cal Corr ON OFF
Cal Sig Level
CAL 10MHz REF
Input Att
IF Step AMP
RBW Switching
Log Linearity
Amplitude MAG
PBW
return
Store
return


LCL
SYS
Ref 10M INT EXT
Date/Time
RS232
GPIB & Others
Trace Point 1001 501
Revision


SHIFT
CONFIG
+ COPY
Printer
Plotter
File
Copy Cancel
Copy Device

4. Restriction on the IC Card

Some cards that even comply with the JEIDA standards cannot be written, read or formatted in this instrument. Please do not use especially the cards that have no attribute memories in them or the cards that have the information of the attribute memories not accurate. Those cards that can be used in PC and so on cannot be used in this instrument.
The restrictions of the usable cards in this instrument are described below.

■ Usable Cards

● SRAM Card
It is permitted to be handled as a floppy disk device.

- JEIDA 4.0 (PCMCIA 2.0) or higher and have capacity 64KB or larger.
- Work with both of that with attribute memory and that without attribute memory.
- Deal with the cards that have no attribute memories or have no contents even if there are the attribute memories as below.
  · Write/Read-out/(Physical/Logical) Format enable
  · It is dealt with as the sector placed at the head of the common memory without single partition/ECC (Error Check Cord).
- Deal with the cards that have only the level1 device information as the attribute information as below.
  · Write/Read-out/(Physical/Logical) Format enable
  · It is dealt with as the sector placed at the head of the common memory without single partition/ECC (Error Check Cord).
- Deal with the cards that have up to the level2 format information as the attribute information as below.
  · Physical format disable
  · It depends on that it is with ECC or without ECC that it enables or disables to read-out or to write.
  Without ECC: Read-out/Write/Logical format enable
  With ECC: Only Read-out enable
- The cards that have plural partition comply with only the partition that is described in the first format information. (Only in the case that partition is the basic DOS partition.)

■ Nonusable Cards

- EPROM card/Flash memory card
  Independent on With attribute memory/Without attribute memory.
- DRAM card
- I/O card

5. List of Messages

Massage	Explanation	Error No.
Sound demodulation is working. Please turn off the Sound mode. [CW 1/2]	Sound demodulation is working.	1
Vertical scale is Linear mode. Please select any dB/div scale. [Level->dB/div]	Vertical scale is set in the Linear mode.	2
Preselector is been tuning. Please select Manual Peaking. [Freq 2/2]	Preselector is been tuning.	3
This parameter is fixed while. Preselector Peaking. [Freq 2/2]	This parameter is not able to be changed while Preselector Peaking.	4
Span is set 0 Hz. Please change a span.	It is set in Zero Span.	5
OBW, ACP or HARM is working. Please quit the measure.	Standards measurement is in execution.	6
Blank trace is selected. Please select Write mode. [Format->Trace A]	It is not able to be executed because it is set in Blank trace.	7
Not available on baseband freq. Please move marker and execute.	It is not able to be executed on Baseband frequency.	8
Power Measure is working. Please turn off each item. [CW->Power Meas]	Power Measure is working.	9
Signal Track is working. Please turn off Signal Track. [Marker 1/3]	Signal Track is working.	10
Noise/Hz is working. Please quit the Noise/Hz. [CW 2/2]	Noise/Hz is working.	11
Only dBm and dBuV is useful while Noise/Hz is been working.	It is not possible to select because Noise/Hz is been working.	12

Massage	Explanation	Error No.
Counter is working. Please turn off the Counter. [CW 1/2]	Counter is working.	13
ΔMKR is not active. Please activate the ΔMKR. [Marker 1/3]	The delta marker is not active.	14
External Mixer is selected. Please set the Mixer INT. [Input 1/1]	The external Mixer mode is selected.	15
Mixer is fixed in Multi Screen mode. [Window 1/1]	The mixer cannot be changed in Multi Screen mode.	16
Not available in Multi Screen. Please reset Multi Screen mode. [Window 1/1]	It is not possible to execute in Multi Screen mode.	17
View or Blank trace is selected. Please select Write mode. [Format->Trace A]	It is not possible to execute in View/Blank.	18
Trigger source is not Video. Please select Video trigger. [Sweep->Trigger Source]	Trigger source is not Video.	19
MKR is not on Trace A. Please execute Trace MKR Move. [Marker 3/3]	The marker is not on Trace A.	20
Signal Ident is working. Please turn off Signal Ident. [Input 1/1]	Signal Ident is working.	21
Vertical scale is not 10 dB/div. Please select 10 dB/div. [Level->dB/div]	The vertical scale is not 10 dB/div.	22
Parameter is set over the scale. Please check the data. [ACP 1/1]	The parameter is not correctly set.	23
Calculated power is out of range.	The calculated power is out of range.	25

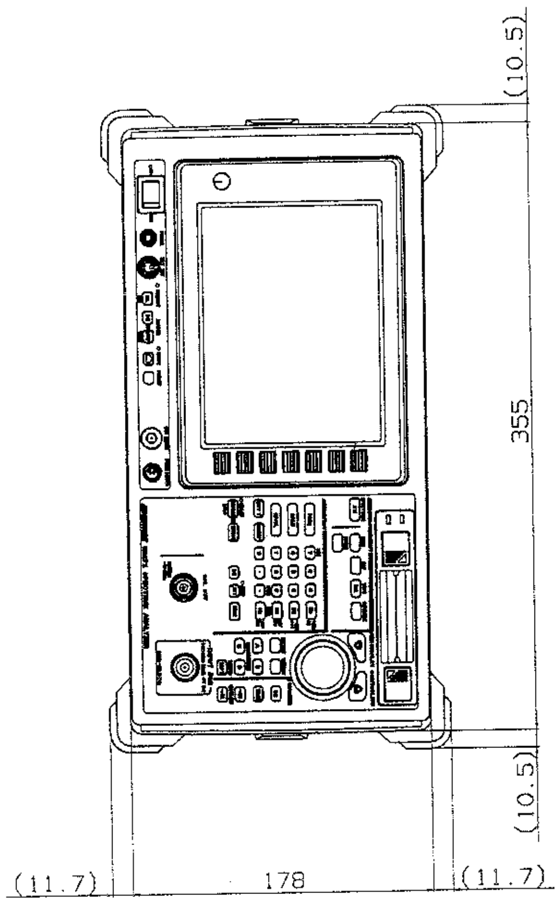
Massage	Explanation	Error No.
Edit table is opened. Please return to execute menu.	It is not possible to execute in the Edit mode.	26
Frequency table is empty. Please edit a table and execute.	There are no table data.	27
Calibration signal was not detected. Please check CAL OUT signal.	There is no CAL signal connected.	28
Internal Mixer is selected. Please set the Mixer EXT. [Input 1/1]	The internal Mixer mode is selected.	37
LOSS : Freq is turned on. Please turn the correction off. [Input->Ext MIX Config]	It is in the mode of frequency correction.	38
Trace Average is working. Please turn Average off. [Format->Trace A]	Trace average is working.	39
Not available while Zooming.	It is not possible to execute while Zooming.	42
Printer is not ready. Please check a printer setting.	It is not possible to print. Please check the printer setting.	300*
Printer cable problem. Please check a cable or connection.	The printer cable is in trouble. Please check a cable or connection.	301*
Printer is not active.	The printer is not active.	302*
Plotter cable problem or Plotter is not active.	The plotter cable is defective or the plotter does not operate.	303*
INPUT ATT: Calibration failure.	It is a failure of the Calibration.	400
IF STEP AMP FAILURE: Please verify EXT reference and setting. Then repeat.	It is a failure of the Calibration. Please verify the 10 MHz reference setting. Change the setting of the reference or connect the EXT reference correctly and then try the calibration again.	401
LOG LINEARITY: Calibration failure.	It is a failure of the Calibration.	402

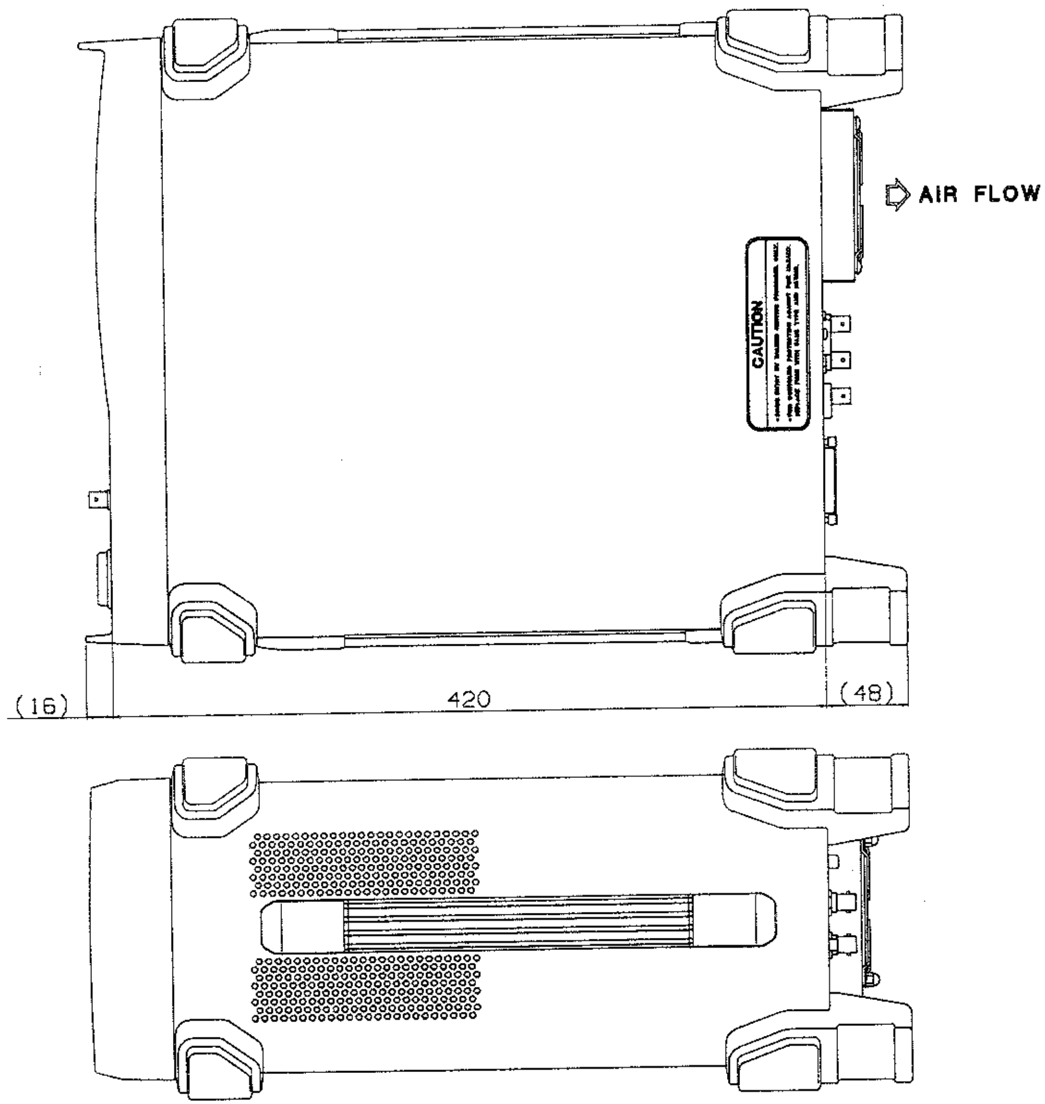
Massage	Explanation	Error No.
TOTAL GAIN: Calibration failure.	It is a failure of the Calibration.	403
RBW SWITCHING: Calibration failure.	It is a failure of the Calibration.	404
AMPTD MAG: Calibration failure.	It is a failure of the Calibration.	405
Calibration data is not enough. Please execute CAL ALL.	It is not possible to execute because some calibration data is missing.	406
NORMAL ADC: Calibration failure.	It is a failure of the Calibration.	409
Illegal parameters.	The specified parameters are illegal.	600
Illegal file or device name.	The file or device name is illegal.	601
Software version unmatched.	Software version is unmatched.	602
Cannot format a device. (Note)	The memory card cannot be initialized.	603
Cannot rename a file in RAM disk.	The file name in RAM disk cannot be changed.	604
Broken saved block data.	The saved data is lost.	605
Device already exists.	The device already has been selected.	606
Device not found.	There are no devices.	607
Device not ready.	The device cannot be referred.	608
Directory not found.	There are no directories.	609
File already exists.	The file already exists.	610
File not found.	There are no files.	611
Invalid BPB. Please format a card.	BPB is invalid. The card needs to be initialized.	612
Cannot delete a file. (read-only file)	It is not possible delete because it is a read-only file.	613
No disk space.	Card/Disk capacity is full.	614
Read-only file.	It is the read-only file.	615

Note:
If the connection of memory card is bad, try format again after the insertion and extraction of it.

Massage	Explanation	Error No.
Read-only media.	It is the read-only media.	616
Read-only volume.	The card is in the write protection.	617
Invalid boot sector signature.	The boot sector signature cannot be recognized.	618
CRC error.	CRC error occurred.	619
File or register empty.	It is impossible to recall a file or register that is empty.	634
Broken Freq-Correction data. Please report to qualified service person.	An error of the frequency characteristic correction data occurred.	621*
Handshake error occurred to TBC. Please report to qualified service person.	A handshake error occurred.	622*
The last process is in progress.	The process in progress becomes to be the last one by pressing STOP key.	800

Note ***:It is possible to read error numbers by using the GPIB query, "ERRNO?", but impossible to read codes marked by (*).***





Unit : mm

CAUTION
This drawing shows external dimensions of this instrument.
The difference in products and options used can cause a change in the appearance of the instrument.

DIMENSIONAL OUTLINE DRAWING

ALPHABETICAL INDEX

[△]

△Y Setting 7-36

[1]

1dB gain compression 11-4
1st LO output 11-6
10MHz frequency reference input/output 11-7

[2]

21.4MHz IF output 11-7

[4]

421MHz IF output 11-7

[A]

Amplitude Accuracy 11-5
Amplitude Condition for Next Peak Search 7-35
Amplitude Range 11-3
Analog Demodulation 11-6
Average display noise level 11-3
Averaging Mode 7-22

[B]

Back Up of the Memory Card .. 6-10
Block Diagram 10-4

[C]

Calibration signal accuracy (30 MHz) 11-5
Calibration signal output 11-7
Carrier frequency (fc) 5-25
Case that abnormality occurs ... 1-11
Center Frequency 7-2
Changing the supply voltage ... 1-5
Checking Power Requirements . 1-5
Cleaning 1-10
Clear File menu 7-71
Clear Register menu 7-67
Command Syntax 8-10
Condition register 8-13
Connectable Printer 6-12
Connecting GPIB 8-3
Connecting the Power Cable ... 1-8
Connecting to AC power source . 3-2
Contents of Storage to Memory Card 6-3
Controller 8-2
Controller Functions 8-6
Convenient functions MKR⇨CF, MKR⇨REF 3-20
Correction Factor Function 7-18
Counter function 7-60

[D]

Data 8-10
Data Formats 8-11
Data output format (talker) 8-43
Data setting 3-7
dB Conversion Formulas A-7
Device Clear (DCL) 8-7
Dialog Box (Setting Menu), Error/Warning Message 3-8
Dimensions 11-8
Direct print 11-8
DISPLAY CONTROL Section ... 2-5
Display range 11-3
Disusable Cards A-18
Dynamic Range 11-3

[E]

Enable register 8-14
ENTRY Section 2-4
Event Enable Register 8-17
Event register 8-13
Example of the program with using the status byte 8-55
Explanation of ACP (Adjacent Channels Leakage Power) Key . 7-55
Explanation of Center Frequency Menu 7-3
Explanation of Detector Mode Menu 7-28
Explanation of Frequency Span Menu 7-6
Explanation of Gated Sweep Function 7-46

Explanation of Limit Line Menu 7-29
Explanation of Next Peak Search Menu 7-33
Explanation of OBW (Occupied Bandwidth) Key 7-52
Explanation of Reference Level Menu 7-7
Explanation of START Lump ... 7-49
Explanation of Sweep Mode Menu 7-45
Explanation of Trigger Level Menu 7-48
Explanation of Trigger Menu ... 7-47
External trigger input 11-7

[F]
Frequency Characteristics 11-2
Frequency measurement in frequency counter mode 5-3
Frequency measurement with normal marker 5-2
Frequency range 11-2
Frequency read accuracy 11-2
Frequency reference accuracy .. 11-2
Frequency response 11-5
Frequency span 11-2
Frequency Span 7-5
Frequency stability 11-2
Frequency Sweep 11-3
Function of CW key 7-59
Function of SHIFT key 3-6
Functions of TRACE mode 7-21

[G]
Gate input 11-7
General Specifications 11-8
Generating response data 8-9
Go To Local (GTL) 8-8
GPIB 8-2
GPIB Interface Functions 8-5
GPIB Setup 8-3

[H]
HARMONICS (higher harmonics) measuring function 7-58
Header 8-10
How to Back up the Memory Card 6-10
How to Call from the Memory Card (Recall Function) 6-9
How to Exchange the Battery ... 6-11
How to Initialize the Memory Card 6-6
How to obtain m when FM modulation index m is small 5-22
How to Store into the Memory Card (Save Function) 6-7

[I]
i/O 11-8
I/O of trace data 8-49
IF gain error (After self-calibration) 11-5
IF Section 10-3
Input Attenuator (ATT) 7-13
Input attenuator range 11-3
Input attenuator switching error . 11-6
Input buffer 8-9
Input Frequencies 3.0 GHz and Above 10-2
Input Frequencies from 9 kHz to 3.1 GHz 10-2
Input Key 7-14
Input of External Mixer Compensation Data 7-17
Input/Output 11-6
Insertion and Ejection of Memory Card 6-5
Installation posture 1-4
Interface Clear (IFC) 8-7
Interface Clear (IFC) 8-7

[L]
Label Function 7-31
Labeling Procedure 7-31
Life Span of the Back Up Battery 6-10
Listener 8-2
Local Lockout (LLO) 8-8
LOG A/D Section 10-3

[M]
Marker frequency counter 11-2
Marker OFF 7-44
Marker ON 7-32
MARKER Section 2-6

Marker → 7-40
Maximum safe input 11-3
Mean power Pave (dBm) 5-25
Measurement by frequency counter 3-17
Measurement Function 11-2
Measurement of power 7-62
Measurement range 11-3
MEASUREMENT Section 2-3
Measurement with normal marker 3-15
Measuring method 5-26
Memory card 11-8
Memory Card Specifications ... 6-3
Message exchange 8-9
Message Exchange Protocol ... 8-9
Mixer Section 10-2
MKR⇒CF function 3-20
MKR⇒CF,MKR⇒REF Function . 7-41
MKR⇒REF function 3-21
Modes of Trace A 7-21
Modes of Trace B 7-25
Multi-marker mode 7-38

[N]

Noise/Hz measurement 7-64
Normal Marker and △ Marker .. 7-32
Note on Handling the Memory Card 6-4
Numeric data 8-11

[O]

Operating environmental conditions 1-3
Operation modes 7-26
Other marker functions 7-42
Output buffer 8-9
Output for Plotter 6-17
Output to the Printer 6-16
Output to the file 6-21

[P]

Panel keys and soft keys 3-5
Peak power (Ppeak) 5-25
Peak Search 7-33
Peak Search Level Changing ... 7-36
Power level measurement by increased display resolution 3-13
Power source 11-8
Power-on 3-3
Program loader 11-8
Pulse quantization error 11-6
Pulse width (τ) 5-25
Purser 8-9

[R]

Recall File menu 7-75
Recall function menu 7-73
Recall function menu 7-76
Recall Register menu 7-74
Reference frequency 4-2
Reference Level 7-7
Reference level range 11-3
Remote Enable (REN) 8-7
Replacing the power fuse 1-6
Resolution bandwidth (3dB) 11-3
Resolution Bandwidth (RBW) ... 7-10
Resolution bandwidth switching error 11-6
Responses to Interface Messages 8-7
RS-232 Remote Control Function 8-59

[S]

Sample measurement of AM wave of high modulation frequency and low modulation index 5-10
Sample measurement of AM wave of low modulation degree and high modulation index 5-6
Sample measurement of approximately 200 MHz signal source 5-2
Sample measurement of FM wave of high modulation frequency and low m value 5-17
Sample measurement of FM wave of low modulation frequency ... 5-14
Sample measurement of the deviation of FM wave peak (Δf peak) 5-19
Save File menu 7-68
Save function menu 7-65

Save Register menu 7-67
Scale indication accuracy
(After self calibration) 11-5
Select Item menu 7-72
Selected Device Clear (SDC) ... 8-8
Selecting AUTO of Coupled
Functions 7-12
Serial Polling Enable (SPE) 8-7
Set condition of the display screen 6-3
Setting 4-2
Setting of External Mixer
Condition 7-15
Setting of GPIB address 8-4
Signal purity noise side band ... 11-2
Signal Track Mode 7-33
Sound function 7-63
Space (space character) 8-10
Specification of the
Output Form 6-13
Spectrum demodulation 11-6
Spurious measurement 7-62
Spurious response 11-4
SRAM Card A-18
Standard Event Register 8-21
Standard Operation Status
Register 8-18
Status Byte Register 8-19
Status Register 8-13
Status Register Structure 8-13
Status Register Types 8-14
Step key and data knob 3-8
Storage 1-10
Sweep Key 7-45
Sweep Mode Switching 7-51
Sweep Time 7-50
Sweep Time Setup Menu 7-51

[T]
Take Control (TCT) 8-8
Talker 8-2
Temperature and humidity 11-8
Ten-key and unit key 3-8
The trace data and the
table data 6-3
To carry the device by hand ... 1-10
Transportation 1-10

[U]
Units 8-12
Usable Cards A-18
Usable Memory Card 6-2

[V]
Video bandwidth 11-3
Video Bandwidth (VBW) 7-11
Video output 11-7
Voice output (Demodulation
audio) 11-8

[W]
Warm up 1-11
Writing multiple commands 8-10

[X]
X axis output 11-7

[Y]
Y axis output 11-7

[Z]
Z axis output 11-7

Part 2

Applicable Instruments
R3465
R3272
R3263
R3463

How to Use This Manual

The following describes the structure of this manual.

- Part 1: Whole explanation for R3465
- Part 2: Performance test (Calibration)
  Applicable instruments are the R3465, R3272, R3263 and R3463.

TABLE OF CONTENTS

1. PERFORMANCE TEST (CALIBRATION) 1-1

1.1 Introductory Description and UUT Performance Requirements 1-1
1.2 Measurement Standards and Support Test Equipment Performance Requirement 1-8
1.3 Preliminary Operations 1-11
1.4 Performance Test Process 1-12
1.4.1 Accuracy of Frequency Readout and Frequency Counter Marker .. 1-12
1.4.2 Frequency Reference Output Accuracy 1-15
1.4.3 Noise Sidebands 1-17
1.4.4 Frequency Span Accuracy 1-19
1.4.5 Resolution Bandwidth Accuracy and Selectivity 1-22
1.4.6 Resolution Bandwidth Switching Uncertainty 1-26
1.4.7 Displayed Average Noise Level 1-29
1.4.8 Gain Compression 1-37
1.4.9 Residual Response 1-41
1.4.10 Second Harmonic Distortion 1-44
1.4.11 Third Order Intermodulation Distortion 1-48
1.4.12 Image, Multiple and Out-of-Band Response 1-52
1.4.13 Frequency Response 1-60
1.4.14 IF Gain Uncertainty 1-74
1.4.15 Scale Fidelity 1-78
1.4.16 Input Attenuator Accuracy 1-84
1.4.17 Calibration Amplitude Accuracy 1-89
1.5 Checklist/Data Form 1-90

LIST OF ILLUSTRATIONS

No.	Title	Page
1-1	Frequency Readout and Frequency Counter Marker Accuracy Test Setup	1-12
1-2	Frequency Reference Accuracy Test Setup	1-15
1-3	Noise Sidebands Test Setup	1-17
1-4	Frequency Span Accuracy Test Setup	1-19
1-5	Resolution Bandwidth Accuracy/Selectivity Setup	1-22
1-6	Resolution BW Switching Uncertainty Test Setup	1-26
1-7	Displayed Average Noise Test Setup	1-30
1-8	Gain Compression Test Setup	1-37
1-9	Residual Response Test Setup	1-41
1-10	Second Harmonic Distortion Test Setup	1-44
1-11	Third Order Intermodulation (<2 GHz) Test Setup	1-48
1-12	Image, Multiple and Out-of-Band Response Test Setup	1-52
1-13	Frequency Response Test Setup	1-61
1-14	IF Gain Uncertainty Test Setup	1-74
1-15	Scale Fidelity Test Setup	1-78
1-16	Input Attenuator Switching Accuracy Test Setup	1-84
1-17	Calibration Amplitude accuracy Test Setup	1-89

LIST OF TABLES

No.	Title	Page
1-1	UUT Performance Requirements	1-2
1-2	Measurement Standards (MS) Performance Requirements	1-9
1-3	Support Measuring & Test Equipment (M&TE) Performance Requirements	1-10
1-4	Frequency Readout Accuracy	1-14
1-5	Marker Frequency Counter Accuracy	1-14
1-6	Noise Sidebands	1-18
1-7	Frequency Span Accuracy	1-21
1-8	Resolution Bandwidth Accuracy	1-24
1-9	Resolution Bandwidth Selectivity	1-25
1-10	Resolution BW Switching Uncertainty	1-28
1-11	Displayed Average Noise Level (R3465)	1-34
	Displayed Average Noise Level (R3272)	1-35
	Displayed Average Noise Level (R3263/3463)	1-36
1-12	Gain Compression	1-40
1-13	Third Order Intermodulation Distortion	1-51
1-14	Image, Multiple and Out-of-Band Responses (R3272)	1-58
1-15	Image, Multiple and Out-of-Band Responses (R3465)	1-59
1-16	Image and Multiple Responses (R3263/3463)	1-59
1-17	Frequency Response(R3465/3272/3263/3463 : 9 kHz to 3.0 GHz Band)	1-68
1-18	Frequency Response (R3465 : 1.7 GHz to 7.0 GHz Band)	1-69
1-19	Frequency Response (R3272 : 3.0 GHz to 7.5 GHz Band)	1-70
1-20	Frequency Response (R3465 : 6.9 GHz to 8 GHz Band)	1-71
1-21	Frequency Response (R3272 : 7.4 GHz to 15.4 GHz Band)	1-71
1-22	Frequency Response (R3272 : 15.2 GHz to 23.3 GHz Band)	1-72
1-23	Frequency Response (R3272 : 23 GHz to 26.5 GHz Band)	1-73
1-24	IF Gain Error (RBW=10 kHz, 1 dB/div.)	1-76
1-25	IF Gain Error (RBW=3 kHz, 1 dB/div.)	1-77
1-26	1 dB/div. Log Scale Fidelity (RBW=3 kHz)	1-81
1-27	10 dB/div. Log Scale Fidelity (RBW=3 kHz)	1-81
1-28	Linear Scale Fidelity (X1)	1-83
1-29	Input Attenuator Accuracy	1-87
1-30	Performance Test Record	1-90

1. PERFORMANCE TEST (CALIBRATION)

1.1 Introductory Description and UUT Performance Requirements

This procedure describes the performance test of the modulation spectrum analyzer R3465/3463 and the spectrum analyzer R3272/3263.

The unit being test will be referred to herein as the UUT (Unit-Under-Test).

UUT Environmental range	: TEMP. 20°C to 30°C RH 85% or less
UUT Warm-up/Stabilization period requirements	: 60 minutes

Table 1-1 UUT Performance Requirements (1 of 6)

Unit-Under-Test (UUT) Parameter/Function	Performance Specifications	Test Method
1. Frequency Readout Accuracy and Frequency Counter Marker Accuracy.	Frequency Readout Accuracy: < ±[Frequency reading × Frequency Reference Accuracy) + (Span × Span Accuracy) + (0.15 × RES.BW) + 10 Hz] Span Accuracy: Span > 5 MHz ± 4% Span ≦ 5 MHz ± 1% Marker Frequency Counter Accuracy: < ± [(Marker Frequency × Frequency Reference Accuracy) + (5 Hz × N) + 1LSD]	Signals are input from the SG where high-precision frequency standard is set as the reference frequency for measurement.
2. Frequency Reference Output Accuracy.	Frequency: $< 1 \times 10^{-7}$/year $< 2 \times 10^{-8}$/day	The frequency of CAL OUT signal locked to the internal 10 MHz reference is measured with the counter.
3. Noise Sidebands	f ≦ 3 GHz: 10 kHz offset < −100 dBc/Hz 100 kHz offset < −110 dBc/Hz f > 3 GHz: 10 kHz offset < (−98 + 20 log N) dBc/Hz 100 kHz offset < (−108 + 20 logN) dBc/Hz	Good noise sideband signals are input for measurement.
4. Frequency Span Accuracy	Linear Span: < ±4% (Span > 5 MHz) < ±1% (Span ≦ 5 MHz)	Signals at two frequencies according to each span are input to measure the difference between the frequencies.
5. Resolution Bandwidth Accuracy and Selectivity	Range Accuracy: 300 Hz to 3 MHz, 5MHz; 1, 3, 10 sequence ±20% 1 kHz to 1 MHz ±30% 300 Hz, 3 MHz, 5MHz Selectivity : < 15:1 300 Hz to 5 MHz Resolution Bandwidth 5 MHz (50 dB/3 dB) Resolution Bandwidth 300 Hz to 3 MHz (60 dB/3 dB)	CAL OUT signals are input for measurement.

Table 1-1 UUT Performance Requirements (2 of 6)

Unit-Under-Test (UUT) Parameter/Function	Performance Specifications	Test Method
6. Resolution Bandwidth Switching Uncertainty	300 Hz to 3 MHz RBW: $< \pm 0.3$ dB (Reference to 300 kHz RBW) ($3 \times$ RBW $\geq$ Span)	CAL OUT signals are input for measurement.
7. Displayed Average Noise Level	(1 kHz res BW, 0 dB input attenuator, 1 Hz video filter) R3465: −70 dBm 10 kHz −80 dBm 100 kHz $-\{115-1.55f(\mathrm{GHz})\}$ dBm 1 MHz to 3.0 GHz −115 dBm 1.7 GHz to 7.0 GHz −115 dBm 6.9 GHz to 8.0 GHz R3272: −70 dBm 10 kHz −80 dBm 100 kHz $-\{115-1.55f(\mathrm{GHz})\}$ dBm 1 MHz to 3.1 GHz −110 dBm 3.0 GHz to 7.5 GHz −103 dBm 7.4 GHz to 15.4 GHz −96 dBm 15.2 GHz to 23.3 GHz −90 dBm 23 GHz to 26.5 GHz R3263/3463: −70 dBm 10 kHz −80 dBm 100 kHz $-\{115-1.55f(\mathrm{GHz})\}$ dBm 1 MHz to 3.0 GHz	No signal is input and average noise level at each frequency is measured.

Table 1-1 UUT Performance Requirements (3 of 6)

<table>
<tr><th>Unit-Under-Test (UUT) Parameter/Function</th><th>Performance Specifications</th><th>Test Method</th></tr>
<tr><td>8. Gain Compression (1 dB)</td><td>−5 dBm mixer input level > 10 MHz</td><td>Two signals are input simultaneously to measure the level at which one of the signals is lowered by 1 dB.</td></tr>
<tr><td>9. Residual Response</td><td>(no signal at input, 0 dB input Attenuator, 50 Ω termination)
R3465:
<table>
<tr><td>< −100 dBm</td><td>1 MHz to 3.0 GHz</td></tr>
<tr><td>< −90 dBm</td><td>300 kHz to 8.0 GHz</td></tr>
</table>
R3272:
<table>
<tr><td>< −100 dBm</td><td>1 MHz to 3.0 GHz</td></tr>
<tr><td>< −90 dBm</td><td>300 kHz to 26.5 GHz</td></tr>
</table>
R3263/3463:
<table>
<tr><td>< −100 dBm</td><td>1 MHz to 3.0 GHz</td></tr>
<tr><td>< −90 dBm</td><td>300 kHz to 3.0 GHz</td></tr>
</table></td><td>No signal is input and the test is terminated at 50 Ω.</td></tr>
<tr><td>10. Second Harmonic Distortion</td><td>R3465:
<table>
<tr><th></th><th>frequency range</th><th>mixer level</th></tr>
<tr><td>< −70 dBc</td><td>10 MHz to 3.0 GHz</td><td>−30 dBm</td></tr>
<tr><td>< −90 dBc</td><td>> 1.7 GHz</td><td>−10 dBm</td></tr>
</table>
R3272:
<table>
<tr><th></th><th>frequency range</th><th>mixer level</th></tr>
<tr><td>< −70 dBc</td><td>10 MHz to 3.0 GHz</td><td>−30 dBm</td></tr>
<tr><td>< −100 dBc</td><td>>3.0 GHz</td><td>−10 dBm</td></tr>
</table>
R3263/3463:
<table>
<tr><th></th><th>frequency range</th><th>mixer level</th></tr>
<tr><td>< −70 dBc</td><td>10 MHz to 3.0 GHz</td><td>−30 dBm</td></tr>
</table></td><td>The lowpass filter is connected to the SG output for measurement.</td></tr>
</table>

Table 1-1 UUT Performance Requirements (4 of 6)

<table>
<tr><th>Unit-Under-Test
(UUT)
Parameter/Function</th><th>Performance Specifications</th><th>Test Method</th></tr>
<tr><td>11. Third Order Intermodulation Distortion</td><td>Separation: 12.5 kHz
Resolution bandwidth: 300 Hz
Video bandwidth: 3 Hz or less

R3465:
<table>
<tr><th></th><th>frequency range</th><th>mixer level</th></tr>
<tr><td>< −75 dBc</td><td>10 MHz to 3.0 GHz</td><td>−30 dBm</td></tr>
<tr><td>< −75 dBc</td><td>>1.7 GHz</td><td>−30 dBm</td></tr>
</table>
R3272:
<table>
<tr><th></th><th>frequency range</th><th>mixer level</th></tr>
<tr><td>< −75 dBc</td><td>10 MHz to 3.0 GHz</td><td>−30 dBm</td></tr>
<tr><td>< −75 dBc</td><td>>3.0 GHz</td><td>−30 dBm</td></tr>
</table>
R3263/3463:
<table>
<tr><th></th><th>frequency range</th><th>mixer level</th></tr>
<tr><td>< −75 dBc</td><td>10 MHz to 3.0 GHz</td><td>−30 dBm</td></tr>
</table>
</td><td>Two neighboring signals are input simultaneously for measurement.</td></tr>
<tr><td>12. Image, Multiple, Out of Band Response</td><td>R3465:
< −70 dBc (10 MHz to 8 GHz)

R3272:
< −70 dBc (10 MHz to 18 GHz)
< −60 dBc (10 MHz to 23 GHz)
< −50 dBc (10 MHz to 26.5 GHz)

R3263/3463:
< −70 dBc (10 MHz to 3 GHz)</td><td>Signals allowing image, multiple and out of band response as against the center frequency are input for measurement.</td></tr>
</table>

Table 1-1 UUT Performance Requirements (5 of 6)

Unit-Under-Test (UUT) Parameter/Function	Performance Specifications	Test Method
13. Frequency Response	10 dB input attenuator R3465: ±1.5 dB 9 kHz to 3.0 GHz ±1.0 dB 50 MHz to 3.0 GHz ±1.5 dB 1.7 GHz to 7.0 GHz ±1.5 dB 6.9 GHz to 8 GHz Frequency Response Referenced to CAL Signal: ±3 dB 9 kHz to 8 GHz R3272: ±1.5 dB 9 kHz to 3.1 GHz ±1.0 dB 50 MHz to 3.1 GHz ±1.5 dB 3.0 GHz to 7.5 GHz ±3.5 dB 7.4 GHz to 15.4 GHz ±4.0 dB 15.4 GHz to 23.3 GHz ±4.0 dB 23 GHz to 26.5 GHz Frequency Response Referenced to CAL Signal: ±5 dB 9 kHz to 26.5 GHz R3263/3463: ±1.5 dB 9 kHz to 3.0 GHz ±1.0 dB 50 MHz to 3.0 GHz Frequency Response Referenced to CAL Signal: ±2 dB 9 kHz to 3.0 GHz	The signal level of SG at a certain level on the screen is measured at each frequency with the power meter.
14. IF Gain Uncertainty	(after automatic calibration) ±0.5 dB 0 dBm to −50 dBm	The REF level is raised while lowering the signal level with the SG to measure the error.
15. Scale Fidelity	(after automatic calibration) Log: ±0.2 dB/1 dB, ±1 dB/10 dB, ±1.5 dB/80 dB Linear: ±15% of reference level (within 8 Div)	Input signal is lowered with the SG for measurement.

Table 1-1 UUT Performance Requirements (6 of 6)

Unit-Under-Test (UUT) Parameter/Function	Performance Specifications	Test Method
16. Input Attenuator Accuracy	(20 dB to 70 dB settings referenced to 10 dB) R3465: ±1.1 dB/10 dB step, 2.0 dB max, 9 kHz to 8 GHz R3272: ±1.1 dB/10 dB step, 2.0 dB max, 9 kHz to 12.4 GHz ±1.3 dB/10 dB step, 2.5 dB max, 12.4 GHz to 18 GHz ±1.8 dB/10 dB step, 3.5 dB max 18 GHz to 26.5 GHz R3263/3463: ±1.1 dB/10 dB step, 2.0 dB max, 9 kHz to 3.0 GHz	Signal at a frequency is input and measured with the internal attenuator.
17. Calibration Amplitude Accuracy	Amplitude: −10 dBm ±0.3 dB	CAL OUT signals are measured with the power meter.

1.2 Measurement Standards and Support Test Equipment Performance Requirement

Minimum-Use-Specifications (MUS) are the calculated minimum performance specifications criteria needed for the Measurement Standards (MS) and support M&TE to be used for the comparison measurements required in the Test Procedure (TP) process.

The MUS is developed through uncertainty analysis and is calculated through assignment of a defines and documented uncertainty/accuracy ratio or margin between the specified tolerances of the UUT and the capability (uncertainty specification) required of the measurement standards system. MUS is required to assist a measurement specialist in the evaluation of existing or selection of alternate measurement standards equipment.

The uncertainty/accuracy ratio applied in this TP is 10:1 and any exception to that is indicated in Section 1.1.

CAUTION

The instructions in this TP relate specifically to the equipment and conditions listed in Section 1.2. If other equipment is substituted, the information and instructions must be interpreted and revised accordingly.

MS and SM&TE Environmental Range	:	Temperature	:	18°C to 28°C
	:	Relative Humidity	:	30% to 70%

MS and SM&TE Warm-up/Stabilization Period Requirements : 60 minutes

Table 1-2 Measurement Standards (MS) Performance Requirements

Equipment Generic Name (Quality)	Minimum-Use-Specifications	Note
Frequency Standard	Output Frequency : 10 MHz Stability : 5×10^{-10}/day Output Impedance : about 50 Ω Output Voltage : 1 Vpp or more	
Synthesized Sweeper	Frequency Range : 10 MHz to 18 GHz Frequency Accuracy (CW): 3×10^{-8}/day Power Level Range : −20 dBm to +15 dBm	SG1
Frequency Counter	Frequency Range : 10 Hz to 120 MHz Gate Time : 10s Number of Digits Displayed : 8 digits Input Voltage Range : 25 mVrms to 500 mVrms	
Synthesized Signal Generator	Frequency Range : 10 MHz to 4 GHz Residual SSB Phase Noise: 1 kHz offset < −115 dBc/Hz 10 kHz offset < −125 dBc/Hz 100 kHz offset < −130 dBc/Hz Power Level Range: −20 dBm to +10 dBm	SG2
Power Meter	Accuracy : ±0.02 dB (dB Relative Mode)	
Power Sensor	Frequency Range : 50 MHz to 26.5 GHz Power Range : 1 μW to 100 mW Maximum SWR : 1.25 (26.5 GHz)	Sensor 1
	Frequency Range : 10 MHz to 18 GHz Power Range : 1 μW to 10 mW	Sensor 2
Synthesized Sweeper	Frequency Range : 10MHz to 26.5 GHz Power Level Range: −20 dBm to +10 dBm	SG3
Synthesized Level Generator	Frequency Range :30 MHz Power Level Range :-60dBm to +10dBm Absolute Level Accuracy : ±0.2 dB	SG4

Table 1-3 Support Measuring & Test Equipment (M&TE) Performance Requirements

Equipment Generic Name (Quality)	Minimum-Use-Specifications	Note
Adapter	Type N(m) to BNC(f)	
	Type N(m) to SMA(f)	
	SMA(m) to SMA(m)	
	Type N(f) to BNC(m)	
50 Ω Termination	SMA	
20dB Fixed, 3dB Fixed Attenuator	Frequency Range : DC to 26.5 GHz Connector : SMA(m), SMA(f)	
Power Splitter	Frequency Range : 10 MHz to 26.5 GHz Insertion Loss : 6 dB (nominal)	
Low-pass Filter	Cutoff Frequency : 2.2 GHz Rejection at 3 GHz : >40 dB Rejection at 3.8 GHz: >80 dB	
Power Divider	Frequency Range : 2 MHz to 2 GHz Isolation : >20 dB	Divider 1
	Frequency Range : 2 GHz to 4 GHz Isolation : >20 dB	Divider 2
Cable	Frequency Range : DC to 26.5 GHz Maximum SWR : <1.45 GHz at 26.5 GHz Length : about 70 cm Connector : SMA(m) both ends	
	Length : 150 cm Connector : BNC(m) both ends	
	Length : 10 cm Connector : BNC(m) both ends	

1.3 Preliminary Operations

WARNING

Always makes sure spectrum analyzer's power supply cord is plugged into a 3-hole grounded outlet or 2-hole outlet with grounded adapter. You can be fatally shocked if you fail to follow this rule.

Do not touch live circuits when calibrating instrument.

(1) Review this entire procedure before starting calibration procedure.

(2) Always confirm that the POWER switch is OFF before connecting the power cable to the AC line.

1.4 Performance Test Process

1.4.1 Accuracy of Frequency Readout and Frequency Counter Marker

- SPECIFICATION

Frequency Readout Accuracy < ± [(Frequency reading × Frequency Reference Accuracy) + (Span × Span Accuracy) + (0.15 × RES.BW) + 10 Hz]

Span Accuracy: Span > 5MHz ±4%
Span ≤ 5MHz ±1%

Marker Frequency Counter Accuracy < ± [(Marker Frequency × Frequency Reference Accuracy)
+ (5 Hz × N) + 1 LSD]

- RELATED ADJUSTMENT
YTO Adjustment
10 MHz Frequency Reference Adjustment

- DESCRIPTION
The accuracy of the R3465/3272/3263/3463 frequency readout and frequency counter marker is tested with an input signal of known frequency.

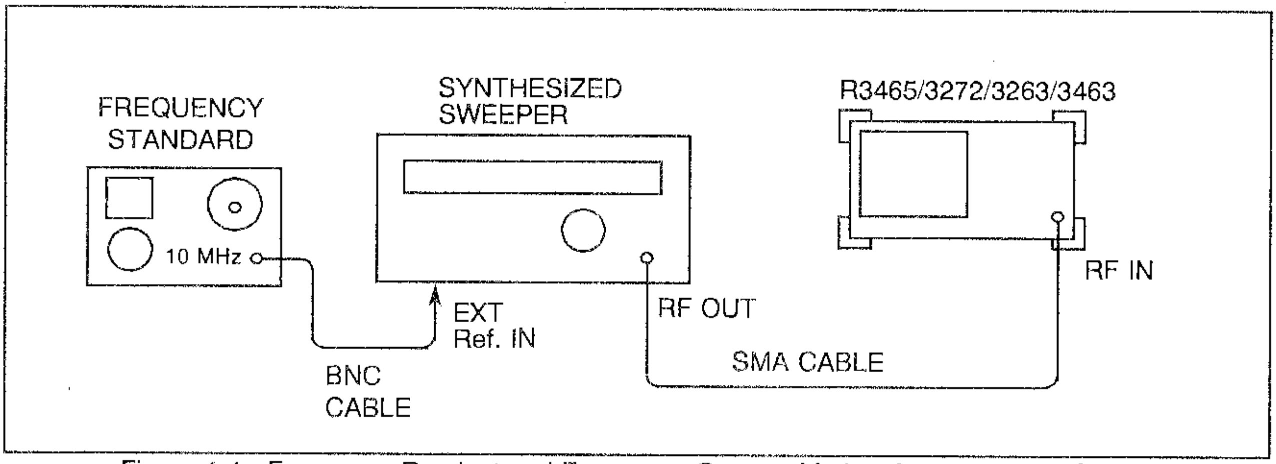


Figure 1-1 Frequency Readout and Frequency Counter Marker Accuracy Test Setup

- EQUIPMENT
  Frequency Standard
  Synthesized Sweeper (SG3)

Cables:
  SMA, 70 cm
  BNC, 150 cm

- PROCEDURE

(1) Connect the equipment as shown in Figure 1-1

[Frequency Readout Accuracy]

(2) Press the INSTRUMENT [PRESET] key on the SG3. Set the SG3 controls as follows:

CW	1.5 GHz
Power Level	−10 dBm
Frequency Reference	EXT (Rear Panel)

(3) On the R3465/3272/3263/3463, press the [SHIFT] and [PRESET] keys and set the controls as follows:

Center Frequency	1.5 GHz
Span	5 MHz

(4) For the R3465, press [FREQ], [more 1/2] and [Preselector 1.7G 3.0G] keys to set the preselector to 3.0 GHz.

(5) On the R3465/3272/3263/3463, press the [SRCH] key. Record the MKR frequency on Table 1-4 as the Actual Marker Reading. The reading should be within the limits shown.

(6) Repeat step (5) for all the frequency and span combinations listed in Table 1-4. Peak the R3465/3272 preselector for and set the Analyzer and the SG3 [CW] key to frequencies of 5 GHz and above.

[Frequency Counter Marker Accuracy]

(7) Set the [SPAN] key of the R3465/3272/3263/3463 to 5 MHz.

Press the [CW], [Counter], [Preselector] and [Counter ON OFF] keys to set the counter to ON.

(8) Key in the SG3 [CW] frequencies and the R3465/3272/3263/3463 center as indicated in Table 1-5. For each pair of settings, press the [SRCH] key and record the MKR frequency at each point in Table 1-5.
The marker readings should be within the limits shown.

Table 1-4 Frequency Readout Accuracy

SG3 Frequency (GHz)	R3465/3272/3263/3463		△Marker Reading		
	Span	Center Frequency	Min. (GHz)	Actual (GHz)	Max. (GHz)
1.5	1 MHz	1.5 GHz	1.499988		1.500012
1.5	10 MHz	1.5 GHz	1.49958		1.50042
1.5	50 MHz	1.5 GHz	1.49784		1.50216
1.5	100 MHz	1.5 GHz	1.4958		1.5042
1.5	2 GHz	1.5 GHz	1.419		1.581
<R3465/3272 ONLY>					
5	1 MHz	5 GHz	4.999987		5.000013
5	10 MHz	5 GHz	4.99958		5.00042
5	50 MHz	5 GHz	4.99784		5.00216
5	100 MHz	5 GHz	4.9958		5.0042
5	2 GHz	5 GHz	4.919		5.081
<R3272 ONLY>					
11	1 MHz	11 GHz	10.999987		11.000013
11	10 MHz	11 GHz	10.99958		11.00042
11	50 MHz	11 GHz	10.99784		11.00216
11	100 MHz	11 GHz	10.9958		11.0042
11	2 GHz	11 GHz	10.919		11.081
18	1 MHz	18 GHz	17.999986		18.000014
18	10 MHz	18 GHz	17.99958		18.00042
18	50 MHz	18 GHz	17.99784		18.00216
18	100 MHz	18 GHz	17.9958		18.0042
18	2 GHz	18 GHz	17.919		18.081

Table 1-5 Marker Frequency Counter Accuracy

SG3 Frequency (GHz)	R3465/3272/3263/3463 Center Frequency (GHz)	Marker Frequency		
		Min.(GHz)	Actual(GHz)	Max.(GHz)
1.5	1.5	1.499999844		1.500000156
<R3465/3272 ONLY>				
5	5	4.999999494		5.000000506
<R3272 ONLY>				
11	11	10.999998889		11.000001111
18	18	17.999998184		18.000001816

1.4.2 Frequency Reference Output Accuracy

- SPECIFICATION

  Frequency: $<1\times10^{-7}$/year, $<2\times10^{-8}$/day

- RELATED ADJUSTMENT

  Frequency Reference Adjustment

- DESCRIPTION

  The 10 MHz reference signal is measured for frequency accuracy by measuring the frequency of the 30 MHz CAL OUTPUT signal. The CAL OUTPUT signal is referenced to the 10 MHz reference.

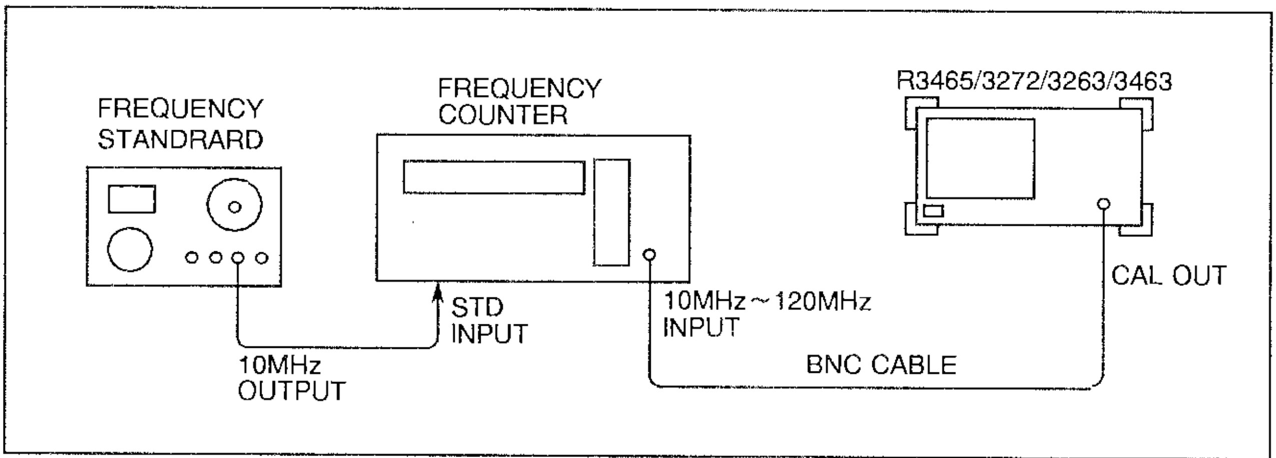


Figure 1-2 Frequency Reference Accuracy Test Setup

- EQUIPMENT

  Frequency Counter
  Frequency Standard

  Cables:
  BNC, 150 cm (Two required)

- PROCEDURE

(1) Connect the equipment as shown in Figure 1-2.

(2) Set the Frequency counter controls as follows:

FREQUENCY STD SWITCH (Rear Panel) .... EXT
GATE TIME .... 10 sec

(3) Press the SHIFT and PRESET keys on the R3465/3272/3263/3463.

CAUTION

Before starting this measurement, perform warm-up operation of the R3465/3272/3263/3463 for more than 30 minutes. If the frequency reference of the R3465/3272/3263/3463 is set to EXT, set it to INT or perform 15-minute warm-up operation after instrument preset.

(4) Wait for the frequency counter to settle down.

(5) Read the frequency counter display. The frequency should be within the following limits:

(2)*9.9999970 ≤ _________ ≤ (2)*0.0000030
*: The counter can display only eight digits.

1.4.3 Noise Sidebands

- SPECIFICATION

  Noise Sidebands:

Offset	f ≤3.0 GHz	f>3.0 GHz
10 kHz	< −100 dBc/Hz	< (−98 + 20 logN) dBc/Hz
100 kHz	< −110 dBc/Hz	< (−108 + 20 logN) dBc/Hz

- RELATED ADJUSTMENT

  There is no related adjustment procedure for this performance test.

- DESCRIPTION

  The noise sidebands of a 1.5 GHz and 3.5 GHz, − 10 dBm signal are measured at an offset of 10 kHz and 100 kHz from the carrier.

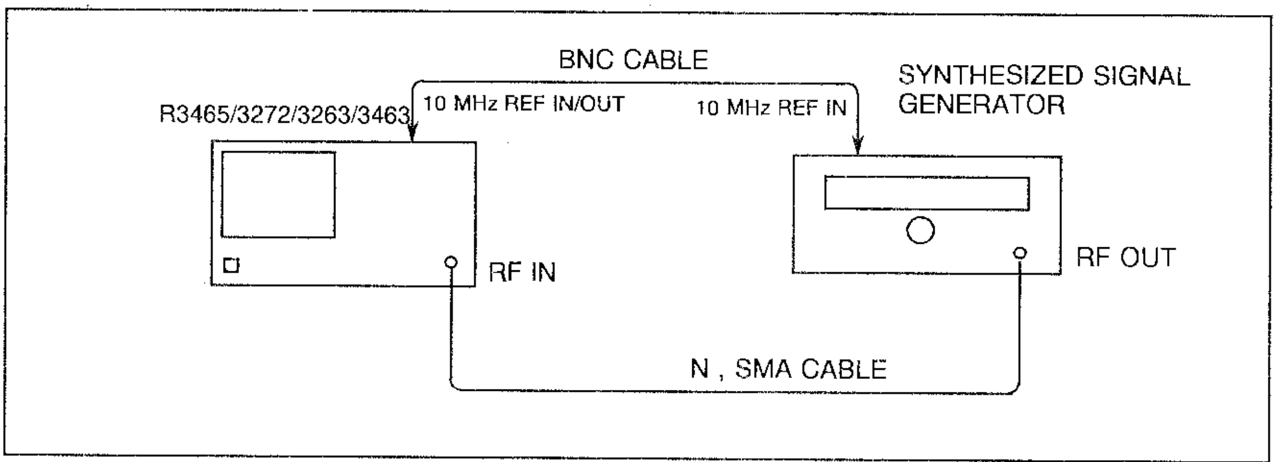


Figure 1-3 Noise Sidebands Test Setup

- EQUIPMENT: Synthesized Signal Generator (SG2)

  Cables: BNC, 150 cm
  SMA, 70cm

- PROCEDURE

(1) Connect the equipment as shown in Figure 1-3.

(2) Set the Signal Generator (SG2) controls as follows:

Frequency .... 1.5 GHz & 3.5 GHz
CW Output .... −5 dBm

(3) Press the SHIFT and PRESET keys on the R3465/3272/3263/3463.
Press FREQ, 1, ., 5 and GHz keys.
Since the measurement is made for each of 10 kHz and 100 kHz offset frequency, set the span frequency to 2.5 times each offset frequency, or 25 kHz and 250 kHz. Keep other settings unchanged.

(4) Operate keys on the R3465/3272/3263/3463 as follows to measure noise sidebands of each offset frequency. The measurement procedure for 100 kHz offset frequency is explained here, and the procedure is applicable for 10 kHz offset frequency.
Set the span corresponding to offset.
Press the →RL key.
Press the CW, more 1/2, NOISE/XHz and dBc/Hz keys.

Press 1, 0, 0 and kHz keys to set each offset frequency.
Press the reference level by 20 dB and perform averaging for about 20 samples. After averaging, read the marker level and write it down in Table 1-6.
For the R3465/3272, measure noise sidebands with the center frequency at 3.5 GHz, and Table 1-6 is completed.

Table 1-6 Noise Sidebands

Offset (kHz)	CF 1.5 GHz		CF 3.5 GHz	
	Actual (dBc/Hz)	Max. (dBc/Hz)	Actual (dBc/Hz)	Max. (dBc/Hz)
10		−100		−98
100		−110		−108

1.4.4 Frequency Span Accuracy

- SPECIFICATION

  $<\ \pm$ 4% of actual frequency separation (SPAN $>$ 5 MHz)

  $<\ \pm$ 1% of actual frequency separation (SPAN $\leq$ 5 MHz)

- RELATED ADJUSTMENT

  Span adjustment.

- DESCRIPTION

Set the signal frequency twice with the synthesized sweeper and measure the difference between signal frequencies with the analyzer.
Check the span accuracy using the signal frequency difference measured with the $\triangle$ MARKER function.

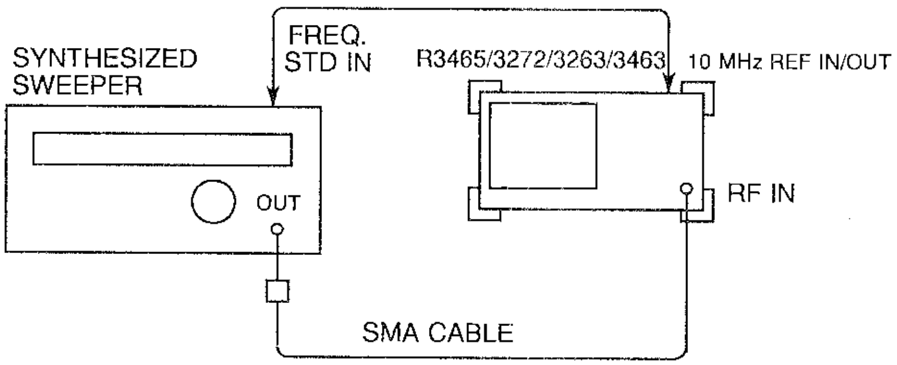


Figure 1-4 Frequency Span Accuracy Test Setup

- EQUIPMENT

  Synthesized Sweeper (SG3)

Cables:

  SMA, 70 cm

  BNC, 150 cm

- PROCEDURE

(1) Connect the equipment as shown in Figure 1-4.

(2) Set the SG3 controls as follows:

CW	1.498 GHz
Power Level	−5 dBm
Frequency STD Switch (Rear Panel)	EXT

(3) On the R3465/3272/3263/3463, press the SHIFT [ ], PRESET [ ] key and set the R3465/3272/3263/3463 controls as follows:

Center Frequency	1.5 GHz
Span	5 MHz

(4) On the R3465/3272/3263/3463, press the [SINGLE], [SRCH], MARKER [ON] and [Delta MKR] keys.

(5) Set the SG3 controls as follows:

CW	1.502 GHz

(6) On the R3465/3272/3263/3463, press the [SINGLE] and [SRCH] keys.
Record the Δ MARKER frequency reading as the Actual Δ MARKER Reading in Table 1-7.
The reading should be within the limits shown.

(7) On the R3465/3272/3263/3463, press the MARKER [ON] and [Normal MKR] keys.

(8) Set the frequency of the SG3, the center frequency and span of the R3465/3272/3263/3463 as shown in Table 1-7, and repeat steps (5) through (8).

Table 1-7 Frequency Span Accuracy

SG3 1st Frequency	SG3 2nd Frequency	R3465/3272/3263/3463		Δ Marker Reading		
		Center Frequency	Span Setting	Min.	Actual	Max.
1.498 GHz	1.502 GHz	1.5 GHz	5 MHz	3.96 MHz		4.04 MHz
1.498 GHz	1.502 GHz	1.5 GHz	5.01 MHz	3.847 MHz		4.169 MHz
1.484 GHz	1.516 GHz	1.5 GHz	40 MHz	30.72 MHz		33.28 MHz
1.34 GHz	1.66 GHz	1.5 GHz	400 MHz	307.2 MHz		332.8 MHz
<R3465/3272 ONLY>						
2.4 GHz	5.6 GHz	4.0 GHz	4 GHz	3.072 GHz		3.328 GHz
0.8 GHz	7.2 GHz	4.0 GHz	8 GHz	6.144 GHz		6.656 GHz
<R3272 ONLY>						
6 GHz	14 GHz	10 GHz	10 GHz	7.68 GHz		8.32 GHz
2 GHz	18 GHz	10 GHz	19 GHz	15.36 GHz		16.64 GHz

1.4.5 Resolution Bandwidth Accuracy and Selectivity

- SPECIFICATION

Range: 300 Hz to 3 MHz, 5 MHz; 1, 3, 10 Sequence

Accuracy: ±20% (Resolution Bandwidth 1 kHz to 1 MHz)
±30% (Resolution Bandwidth 300 Hz, 3 MHz, 5 MHz)

Selectivity: <15:1 (300 Hz to 5 MHz)
(Resolution Bandwidth 5 MHz 50dB BW/3 dB BW)
(Resolution Bandwidth 300 Hz to 3 MHz
60dB BW/3 dB BW)

- RELATED ADJUSTMENT

- DESCRIPTION

This test measures the resolution bandwidth accuracy and selectivity. The 60 dB bandwidth is then determined and the results used to calculate the selectivity for each bandwidth.

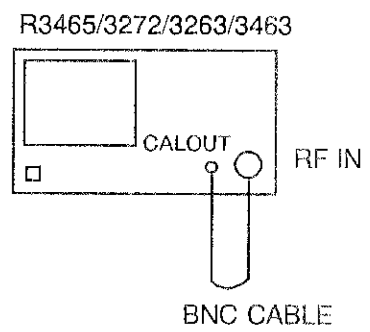


Figure 1-5 Resolution Bandwidth Accuracy/Selectivity Setup

- EQUIPMENT

Adapters :
Typed N(m) to BNC (f)

Cable:
BNC 10 cm

- PROCEDURE

[Resolution Bandwidth Accuracy]

(1) Connect the R3465/3272/3263/3463 CALOUT to the RF IN as shown in Figure 1-5.

(2) Press SHIFT [▬], PRESET [ ] keys and set the controls as follows:

Press [FREQ], [3], [0] and [MHz] keys.

Press [SPAN], [1], [5] and [MHz] keys.

Press [LEVEL], [5], [-dBm], [dB/div] and [1dB/DIV] keys.

Press [BW], [RBW AUTO MNL], [5] and [MHz] keys.

Press FORMAT [ ], [Trace Detector] and [Posi] keys.

(3) Press [SINGLE] key, and wait for a new sweep to finish.

(4) Press [SRCH], MARKER [ON], [more 1/3], [X dB DOWN], [3] and [dB] keys.

(5) Record the marker frequency in Tables 1-8 and 1-9 as actual 3 dB bandwidth.

(6) Change the RBW and span frequency as shown in Table 1-8, and repeat steps (3), (4) and (5) for remaining RBWs.

[Resolution Bandwidth Selectivity]

(7) Press SHIFT [▬], PRESET [ ] and set the controls as follows:

Press [FREQ], [3], [0] and [MHz] keys.

Press [SPAN], [2], [5] and [MHz] keys.

Press [BW], [RBW AUTO MNL], [5] and [MHz] keys.

Press [VBW AUTO MNL], [1], [0] and [kHz] keys.

Press FORMAT [ ], [Trace Detector] and [Posi] keys.

(8) Press [SINGLE] key.

(9) Press [SRCH], MARKER [ON], [more 1/3], [x dB DOWN], [5], [0] and [dB] keys.

(10) Record the marker frequency in Table 1-9 as actual 60 dB bandwidth.

(11) Divide the 60 dB bandwidth by the 3 dB bandwidth and record as the Actual Resolution Bandwidth Selectivity in Table 1-9.

(12) Change the RBW and span frequency as shown in Table 1-9, and repeat steps (8) through (11) for remaining RBWs.

Set VBW to AUTO if RBW is 10kHz or below.

Table 1-8 Resolution Bandwidth Accuracy

Resolution Bandwith Setting	Frequency Span Setting	3dB Bandwidth		
		Min.	Actual	Max.
5 MHz	10 MHz	3.50 MHz		6.5 MHz
3 MHz	5 MHz	2.1 MHz		3.9 MHz
1 MHz	2 MHz	800 kHz		1.2 MHz
300 kHz	500 kHz	240 kHz		360 kHz
100 kHz	200 kHz	80 kHz		120 kHz
30 kHz	50 kHz	24 kHz		36 kHz
10 kHz	20 kHz	8.0 kHz		12.0 kHz
3 kHz	5 kHz	2.4 kHz		3.6 kHz
1 kHz	2 kHz	800 Hz		1200 Hz
300 Hz	2 kHz	210 Hz		390 Hz

Table 1-9 Resolution Bandwidth Selectivity

Resolution Bandwidth Setting	Frequency Span Setting	60 dB Bandwidth	3 dB Bandwidth	Selectivity	
				Actual	Max.
*1) 5 MHz	25 MHz				
3 MHz	25 MHz				15
1 MHz	20 MHz				15
300 kHz	5 MHz				15
100 kHz	1 MHz				15
30 kHz	500 kHz				15
10 kHz	200 kHz				15
3 kHz	50 kHz				15
1 kHz	20 kHz				15
300 Hz	5 kHz				15

*1: RBW 5MHz Selectivity = 50 dB/3 dB

1.4.6 Resolution Bandwidth Switching Uncertainty

- SPECIFICATION

  300 Hz to 3 MHz RES BW: < ± 0.3 dB (referred to 300 kHz RBW)

- RELATED ADJUSTMENT

  There is no related adjustment procedure for this performance test.

- DESCRIPTION

  This test utilizes the CALOUT signal for measuring the switching uncertainty between resolution bandwidths. At each resolution bandwidth setting, the displayed amplitude variation of the signal in measured. All measurements are referenced to the 300 kHz bandwidth.

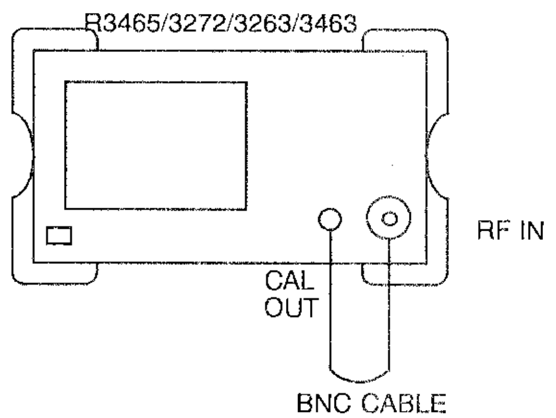


Figure 1-6 Resolution BW Switching Uncertainty Test Setup

- EQUIPMENT

  Adapters :
  Typed N(m) to BNC (f)

  Cable:
  BNC 10 cm

- PROCEDURE

(1) Connect the R3465/3272/3263/3463 CALOUT to the RF IN as shown in Figure 1-6.

(2) Press the [SHIFT ■], [PRESET], [CAL 7], [EACH ITEM] and [RBW SWITCH] keys.

Wait for the "Calibration in progress" message to disappear.
Set the instrument controls as follows:

Center Frequency	30 MHz
Span	500 kHz
Ref Level	−5 dBm
RBW	300 kHz
Sweep Mode	SINGLE
dB/Div	1 dB/Div
Trace Detector	Posi

(3) Press the [SINGLE], [SRCH], [ON], [Delta MKR] and [FIXED MKR ON OFF] keys to set the MKR to ON.

(4) Set the frequency span and RBW to the values listed in the second entry of Table 1-10 (Span 5 MHz, RBW 3 MHz).

(5) Press the [SINGLE], [SRCH] keys.

Record the △MARKER amplitude in the Actual△ MARKER Reading column of Table 1-10. The MARKER reading should be within the limit shown.

(6) Repeat steps (4) and (5) for each set of frequency span and RBW settings in Table 1-10.

Table 1-10 Resolution BW Switching Uncertainty

R3465/3272/3263/3463		Δ Marker Reading		
Span	RBW	Min. (dB)	Actual	Max. (dB)
500 kHz	300 kHz	0	0 (Ref.)	0
5 MHz	3 MHz	−0.3		+0.3
2 MHz	1 MHz	−0.3		+0.3
200 kHz	100 kHz	−0.3		+0.3
50 kHz	30 kHz	−0.3		+0.3
20 kHz	10 kHz	−0.3		+0.3
5 kHz	3 kHz	−0.3		+0.3
2 kHz	1 kHz	−0.3		+0.3
2 kHz	300 Hz	−0.3		+0.3

1.4.7 Displayed Average Noise Level

- SPECIFICATIONS

Displayed Average Noise level: Resolution bandwidth 1 kHz, input attenuator 0 dB, video bandwidth 1 Hz.

R3465

Frequency range	Average Noise Level
10 kHz	−70 dBm
100 kHz	−80 dBm
1 MHz to 3.0 GHz	$-\{115-1.55\times f(\text{GHz})\}$ dBm
1.7 GHz to 8.0 GHz	−115 dBm

R3272

Frequency range	Average Noise Level
10 kHz	−70 dBm
100 kHz	−80 dBm
1 MHz to 3.1 GHz	$-\{115-1.55\times f(\text{GHz})\}$ dBm
3.0 GHz to 7.5 GHz	−110 dBm
7.5 GHz to 15.4 GHz	−103 dBm
15.2 GHz to 23.3 GHz	−96 dBm
23 GHz to 26.5 GHz	−90 dBm

R3263/3463

Frequency range	Average Noise Level
10 kHz	−70 dBm
100 kHz	−80 dBm
1 MHz to 3.0 GHz	$-\{115-1.55\times f(\text{GHz})\}$ dBm

- RELATED ADJUSTMENT

Frequency response adjustment

- DESCRIPTION

This test measures the displayed average noise level in all frequency tests. The analyzer's input is terminated at 50 Ω. In Band 1, in the frequency range from 9 kHz to 3.0 GHz, the test first measures the average noise at 10 kHz and 100 kHz, then at any frequency point in zero span. For the rest of Band 1, and for all remaining bands, the test tunes the analyzer frequency across the band, uses the marker to locate the frequency with the highest response, and then reads the average noise in zero span.

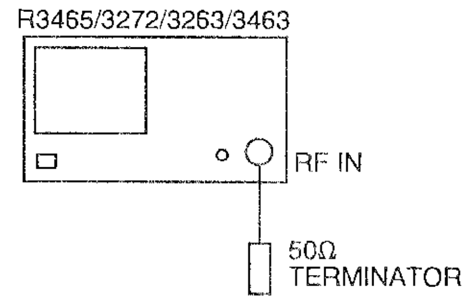


Figure 1-7 Displayed Average Noise Test Setup

- EQUIPMENT

50 Ω Terminator

- PROCEDURE

[Displayed Average Noise, Band 0]

(1) Connect the equipment as shown in Figure 1-7.

Press [SHIFT], [PRESET] keys and set the controls as follows:

Center Frequency	10 kHz
Span Frequency	0 Hz
Reference Level	−60 dBm
Resolution Bandwidth	1 kHz
Video Bandwidth	1 Hz
Input Attenuator	0dB

(2) Press [SINGLE] key and wait for a new sweep to finish, then press [SRCH] key.

(3) Read the marker level and record it in Table 1-11 as the Displayed Noise Level at 10kHz.

(4) Press [FREQ], [1], [0], [0] and [kHz] keys.

(5) Press [SINGLE] key and wait for a new sweep to finish, then press [SRCH] key.

(6) Read the marker level and record it in Table 1-11 as the Displayed Noise Level at 100 kHz.

(7) For the R3465, press [FREQ], [more 1/2] and [Preselector 1.7G 3.0G] keys to set the preselector to 3.0 GHz.

(8) Change the center frequency to each of the values listed in column 1 of Table 1-11 and repeat step 5 sequentially. Read the marker level and record it in Table 1-11 as the Displayed Noise level at Center Frequency.

[Displayed Average Noise Level, Band 1 (R3465/3272)]

(9) Press SHIFT [ ], PRESET [ ] keys and set the controls as follows:

Start Frequency	1.7 GHz (3.0GHz for R3272)
Stop Frequency	7.0 GHz (7.5 GHz for R3272)
Reference Level	−40 dBm
Resolution Bandwidth	3 MHz
Video Bandwidth	100 kHz
Input Attenuator	0 dB

(10) Press FORMAT [ ], [Trace], [AVG A], [1], [0], [Hz] keys and wait for averaging to finish.

(11) Press [→CF] and [WRITE A] keys.

(12) Set the controls as follows:

Span Frequency	0 Hz
Reference Level	−60 dBm
Resolution Bandwidth	1 kHz
Video Bandwidth	1 Hz

(13) Press [SINGLE] and [SRCH] keys.

(14) Read the marker level and record it in Table 1-11 as the Displayed Average Noise Level from 1.7 GHz (3.0 GHz for R3272) to 7.0 GHz (7.5 GHz for R3272).

[Displayed Average Noise Level, Band 2 (R3465/3272)]

(15) Press SHIFT [▬], PRESET [ ] and set the controls as follows:

Start Frequency	6.9 GHz (7.4 GHz for R3272)
Stop Frequency	8.0 GHz (15.4 GHz for R3272)
Reference Level	−40 dBm
Resolution Bandwidth	3 MHz
Video Bandwidth	100 kHz
Input Attenuator	0 dB

(16) Repeat steps (10) through (13).

(17) Read the marker level and record it in Table 1-11 as the Displayed Noise level from 6.9 GHz (7.4 GHz for R3272) to 8.0 GHz (15.4 GHz for R3272).

[Displayed Average Noise, Band 3 (R3272 only)]

(18) Press SHIFT [▬], PRESET [ ] and set the controls as follows:

Start Frequency	15.201 GHz
Stop Frequency	23.3 GHz
Reference Level	−40 dBm
Resolution Bandwidth	3 MHz
Video Bandwidth	100 kHz
Input Attenuator	0 dB

(19) Repeat steps (10) through (13).

(20) Read the marker level and record it in Table 1-11 as the Displayed Average Noise Level from 15.2 GHz to 23.3 GHz.

[Displayed Average Noise, Band 4 (R3272 only)]

(21) Press SHIFT [ ], PRESET [ ] and set the controls as follows:

Start Frequency	23.001 GHz
Stop Frequency	26.5 GHz
Reference Level	−40 dBm
Resolution Bandwidth	3 MHz
Video Bandwidth	100 kHz
Input Attenuator	0 dB

(22) Repeat steps (10) through (13).

(23) Read the marker level and record it in Table 1-11 as the Displayed Average Noise Level from 23 GHz to 26.5 GHz.

Table 1-11 Displayed Average Noise Level (R3465)

Frequency	Displayed Average Noise Level (dBm)	Specification (dBm)
10 kHz		−70.0
100 kHz		−80.0
1.1 MHz		−114.99
101 MHz		−114.84
501 MHz		−114.22
1001 MHz		−113.45
1501 MHz		−112.67
2001 MHz		−111.90
2501 MHz		−111.12
2999 MHz		−110.35
1.7 GHz to 7.0 GHz		−115.0
6.9 GHz to 8 GHz		−115.0

Table 1-11 Displayed Average Noise Level (R3272)

Frequency	Displayed Average Noise Level (dBm)	Specification (dBm)
10 kHz		−70.0
100 kHz		−80.0
1.1 MHz		−114.99
101 MHz		−114.84
501 MHz		−114.22
1001 MHz		−113.45
1501 MHz		−112.67
2001 MHz		−111.90
2501 MHz		−111.12
2999 MHz		−110.35
3.0 GHz to 7.5 GHz		−110.0
7.4 GHz to 15.4 GHz		−103.0
15.2 GHz to 23.3 GHz		−96.0
23 GHz to 26.5 GHz		−90.0

Table 1-11 Displayed Average Noise Level (R3263/3463)

Frequency	Displayed Average Noise Level (dBm)	Specification (dBm)
10 kHz		−70.0
100 kHz		−80.0
1.1 MHz		−114.99
101 MHz		−114.84
501 MHz		−114.22
1001 MHz		−113.45
1501 MHz		−112.67
2001 MHz		−111.90
2501 MHz		−111.12
2999 MHz		−110.35

1.4.8 Gain Compression

- SPECIFICATION
  −5 dBm (mixer level) > 10 MHz

- RELATED ADJUSTMENT
  There is no related adjustment procedure for this performance test.

- DESCRIPTION
  This test means gain compression in the low and high bands.
  Two signals, separated by 1 MHz, are used. First a −30 dBm signal is placed at the input of the R3465/3272/3263/3463.
  After that, input a signal at −5 dBm or above and increase its signal level. The initial signal level at −30 dBm is lowered. Measure the input level when the signal is lowered by 1 dB.

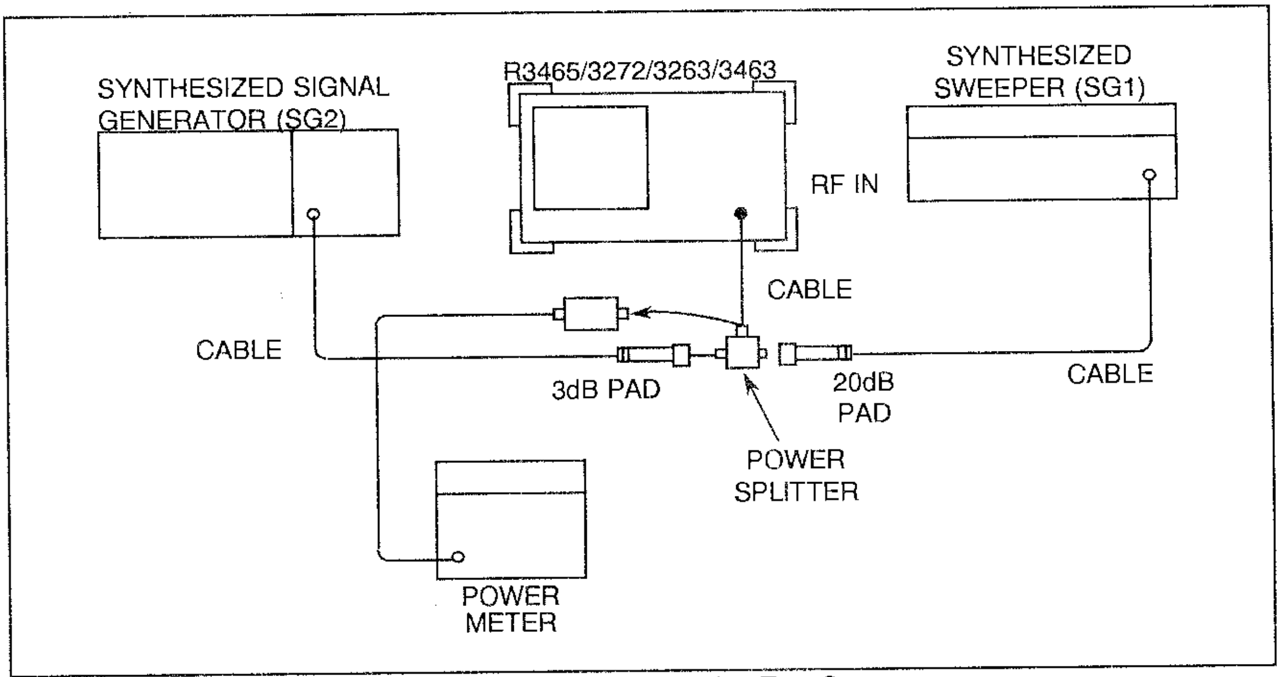


Figure 1-8 Gain Compression Test Setup

- EQUIPMENT

Synthesized Sweeper (SG1)
Synthesized Signal Generator (SG2)
Power Meter
Power Sensor (Sensor 1)
Power Splitter
20 dB Pad
3 dB Pad
Cable: SMA (Three required)

- PROCEDURE

(1) Zero and calibrate the power meter.

(2) Connect the equipment as shown in Figure 1-8.

(3) Press the INSTR PRESET by on both the SG1 and the SG2.
Set the controls for the SG2 as follows:

CW .... 821 MHz
Power Level .... −2 dBm

(4) Set the controls for the SG1 as follows:

CW .... 820 MHz
Power Level .... −4 dBm

(5) On the R3465/3272/3263/3463, press the [SHIFT] and [PRESET] keys.
Set the R3465/3272/3263/3463 controls as follows:

Center Frequency .... 820.5 MHz
Span .... 2 MHz
ATT .... 0 dB
dB/div .... 1 dB/div

(6) On the R3465/3272/3263/3463, press the [LEVEL], [3], [0] and [-dBm] keys.

(7) On the SG2, set the output to OFF.

(8) Adjust the power level of the SG1 for a displayed signal level of −30 dBm ± 0.1 dB on the R3465/3272/3263/3463 screen.

(9) On the SG2, set the output to ON.

(10) Turn the power level knob on the SG2 until the signal level at 2.5 div. in the lefthand part on the R3465/3272/3263/3463 screen is lowered by 1 dB from −30 dBm. If the power level knob cannot be turned any more, stop it there.

(11) Remove the SMA cable from the input terminal of the R3465/3272/3263 and connect the power sensor there.

(12) Record the amplitude reading on the power meter.
It should be greater than −5 dBm ____________ dBm

The following steps are to be performed for the R3465 and R3272.

(13) Rotate the CAL FACTOR switch to the power sensor's 3.2 GHz calibration factor.
On the SG2, set the output to OFF.

(14) Set the SG2 controls as follows:

CW .... 3.201 GHz
Power Level .... -2dBm

(15) Set the SG1 controls as follows:

CW .... 3.2 GHz

(16) Set the R3465/3272 controls as follows:

Center Freq .... 3.2005 GHz
Span .... 2 MHz
Ref Level .... −10 dBm
dB/div .... 10 dB

(17) On the R3465/3272, press [FREQ] key, [more 1/2], [PRESELE] and [AUTO PEAKING] keys.
Wait for the "peaking!!" message to disappear.
Set the dB/div to 1dB/div.

(18) Repeat steps (6) through (11).

(19) Record the amplitude reading on the power meter.
It should be greater than −5 dBm.

____________ dBm

Table 1-12 Gain Compression

R3465/3272/3263/3463 Center Freq (MHz)	SG1 CW (MHz)	SG2 CW (MHz)	1dB Gain Compression level (dBm)
820.5	820	821	
3200.5	3200	3201	

1.4.9 Residual Response

- SPECIFICATION

Model	Frequency range	Residual response
R3465:	1 MHz to 3.0 GHz	< – 100 dBm
	300 kHz to 8 GHz	< – 90 dBm
R3272:	1 MHz to 3.0 GHz	< – 100 dBm
	300 kHz to 26.5 GHz	< – 90 dBm
R3263/3463:	1 MHz to 3.0 GHz	< – 100 dBm
	300 kHz to 3.0 GHz	< – 90 dBm

(with no signal at input and 0 dB input attenuator. RF INPUT is terminated in 50 Ω.)

- RELATED ADJUSTMENT
  There is no related adjustment for this performance test.

- DESCRIPTION
  This test checks for residual responses. Any response located above the display line is measured in a narrow frequency span and resolution bandwidth. The RF INPUT is terminated in 50 Ω.

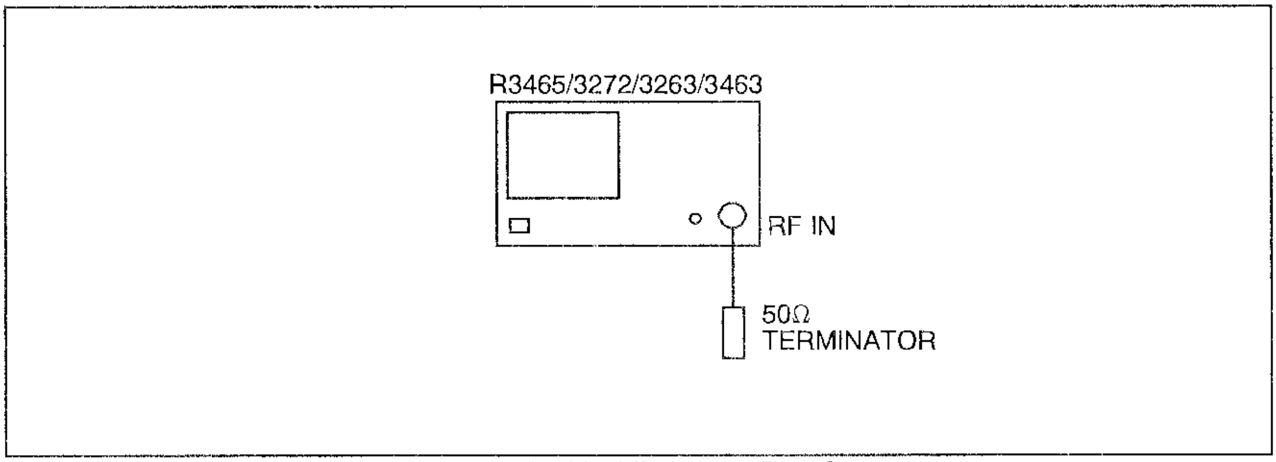


Figure 1-9 Residual Response Test Setup

- EQUIPMENT
  Coaxial 50 Ω Termination
  Adapters:
    Type N to SMA
    Type N to BNC
  Cable:
    BNC, 150cm

- PROCEDURE

(1) Install the Type N to SMA adapter and 50 Ω termination on the RF INPUT. Press the SHIFT, PRESET key and set the controls as follows:

Center Frequency	1.3 MHz
Span	2 MHz
CF Step	1.9 MHz
Ref Level	−50 dBm
ATT	0 dB
RES BW	10 kHz
Video BW	300Hz

(2) For the R3465, press the FREQ, more 1/2 and Preselector 1.7G 3.0G to set the preselector to 3.0 GHz.

(3) Press the FORMAT, DSP LINE ON OFF, 1, 0, 0 and -dBm keys.

Press the SINGLE key.

The noise level should be at least 3 dB below the display line. If it is not, it will be necessary to reduce the Span and RES BW to reduce the noise level.
If the Span is reduced, reduce the CF Step to no more than 95 % of the Span.

(4) If a residual is suspected, press the SINGLE key again. A residual response will persist, but a noise peak will not. Record the frequency and amplitude of any responses above the display line.

(5) If a response is marginal, verify the response amplitude as follows:

① Press the [REPEAT] key.

② Place the marker on the peak of the response in question.

③ Press the [→CF] key.

④ Press the [BW] and RBW [AUTO] [MNL] keys to set the RBW to AUTO.

⑤ Continue to reduce the Span until a RES BW of 300 Hz is reached.

Press the [→CF] key.

⑥ Record the frequency and amplitude of any residual response above the display line.

(6) Check for residuals up to 3.0 GHz using the procedure of step (3) through (5) above. To change the center frequency, then press the [FREQ] and [⇧] keys.

<<Residual Response, 1.7 GHz (3.0 GHz for R3272) to 8.0 GHz (26.5 GHz for R3272) Band>>

(7) Set the R3465/3272 as follows:

Center Frequency	1.725 GHz (3.025 GHz for R3272)
Span	50 MHz
CF Step	47.5 MHz
RES BW	300 kHz
Video BW	300 Hz

Press the [DSP LINE ON/OFF], [9], [0], [-dBm] keys.

(8) For the R3465, press [FREQ], [more 1/2] and Preselector [1.7G] [3.0G] to set the preselector to 1.7 GHz.

(9) Check for residuals up to center frequency 7.975 GHz (26.475 GHz for the R3272) using the procedure of steps (3) through (5) above. To change the center frequency, then press the [FREQ] and [⇧] keys.

1.4.10 Second Harmonic Distortion

- SPECIFICATION

R3465:
- −70 dBc (10 MHz to 3.0 GHz, −30 dBm mixer level)
- −90 dBc (>1.7 GHz, −10 dBm mixer level)

R3272:
- −70 dBc (10 MHz to 3.0 GHz, −30 dBm mixer level)
- −100 dBc (>3.0 GHz, −10 dBm mixer level)

R3263/3463: — −70 dBc (10 MHz to 3.0 GHz, −30 dBm mixer level)

- RELATED ADJUSTMENT

There is no related adjustment procedure for the performance test.

- DESCRIPTION

A synthesized sweeper and low-pass filter provide the signal for measuring second harmonic distortion. The low-pass filter eliminates any harmonic distortion originating at the signal source. The R3465/3272/3263/3463 frequency response is calibrated. The synthesized sweeper is phase-locked to the spectrum analyzer's 10 MHz reference.

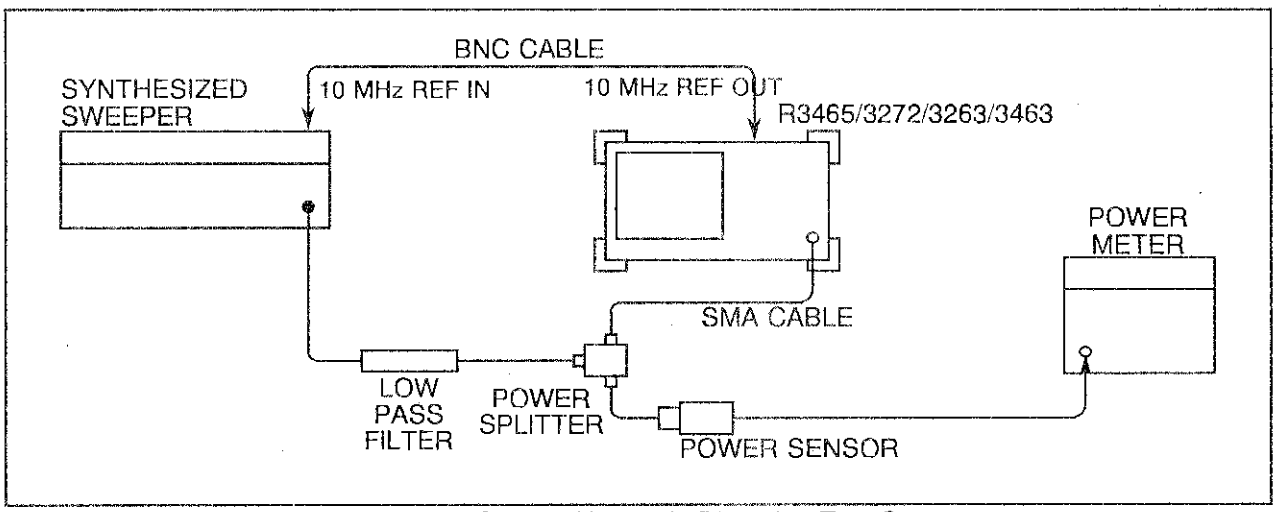


Figure 1-10 Second Harmonic Distortion Test Setup

- EQUIPMENT

Synthesized Sweeper (SG1)
Power Meter
Power Sensor
Power Splitter
2 GHz Low-pass Filter
Adapter:
  Type N to SMA
Cables:
  BNC, 150 cm
  SMA, 70 cm

- PROCEDURE

[9 kHz to 3.0 GHz Band]

(1) Zero and calibrate the power meter. Rotate the CAL FACTOR switch to the power sensor's 1.4 GHz calibration factor.

(2) Connect the equipment as shown in Figure 1-10.

(3) Press the [INSTR PRESET] key on the SG1. Set the SG1 controls as follows:

CW	1.4 GHz
Power Level	0 dBm
Frequency Standard Switch (rear panel)	EXT 10 MHz

(4) On the R3465/3272/3263/3463, press SHIFT [ ], PRESET [ ] keys and set the controls as follows:

Center Frequency	1.4 GHz
Span	10 kHz
VBW	30 Hz
ATT	20 dB
Ref Level	−10 dBm

(5) Set the SG1 [POWER LEVEL] key for a -10 dBm ±0.1 dB reading on the power meter.

(6) For the R3465, press [FREQ], [more 1/2] and [Preselector 1.7G 3.0G] to set the preselector to 3.0 GHz.

(7) On the R3465/3272/3263/3463, press [SINGLE], [SRCH], MARKER [ON], [Delta MKR], [more 1/3] and [FIXED MKR ON OFF] keys to set the FIXED MKR to ON.

(8) On the R3465/3272/3263/3463, press [FREQ], [2], [.], [8], [GHz] and [SINGLE] keys.
Wait for completion of the sweep.
Press [SRCH] and record the Δ MKR amplitude.
It should be less than -70 dBc.

Second Harmonic Distortion (<3.0 GHz)__________dBc

[>1.7 GHz (3.0 GHz for R3272) Band (R3465/3272)]

(9) On the R3465/3272, press SHIFT [ ], PRESET [ ] keys and set the controls as follows:

Center Frequency .... 3.8 GHz
Span .... 500 kHz

(10) Set the SG1 controls as follows:

CW .... 3.8 GHz
Power Level .... −10 dBm

(11) On the R3465/3272, press [FREQ], [more 1/2], [PRESELE] and [AUTO PEAKING] keys.
Wait for the "peaking" message to disappear.

(12) Set the SG1 controls as follows:

CW .... 1.9 GHz
Power Level .... 0 dBm

(13) Connect the equipment as shown in Figure 1-10.

(14) Rotate the CAL FACTOR switch to the power sensor's 1.9 GHz calibration factor.

(15) Set the SG1 [POWER LEVEL] key for a 0 dBm ±0.1 dB reading on the power meter.

(16) On the R3465/3272, press [FREQ], [1], [.], [9] and [GHz] keys.
Press [SPAN], [5] and [kHz] keys.

Press [SRCH], MARKER [ON], [Delta MKR] and [FIXED MKR ON OFF] to set the FIXED MKR to ON.

On the R3465/3272, press [FREQ], [3], [.], [8] and [GHz] keys.
Press [LEVEL], [4], [0] and [-dBm] keys.

Press FORMAT [ ], [Trace], [AVG A], [1], [0] and [Hz] keys.

Wait for the end of 10 averagings.
Press [SRCH] and record the Δ MKR amplitude.
It should be less than −100 dBc

Second Harmonic Distortion (>1.7 GHz (3.0 GHz for R3272))
_____________dBc

1.4.11 Third Order Intermodulation Distortion

- SPECIFICATION

For a total mixer input level* of -30 dBm:

R3465	R3272	R3263/3463
10 MHz to 3.0 GHz : < −75 dBc 1.7 GHz to 8 GHz : < −75 dBc	10 MHz to 3.0 GHz : < −75 dBc 3.0 GHz to 26.5 GHz : < −75 dBc	10 MHz to 3.0 GHz : −75 dBc

* Total mixer input level = Total Input Level - Input Attenuation

Converted Specification for a total mixer input level* of -20dBm:

R3465	R3272	R3263/3463
10 MHz to 3.0 GHz : < −55 dBc 1.7 GHz to 8 GHz : < −55 dBc	10 MHz to 3.0 GHz : < −55 dBc 3.0 GHz to 26.5 GHz : < −55 dBc	10 MHz to 3.0 GHz : −55 dBc

- RELATED ADJUSTMENT

There is no related adjustment procedure for this performance test.

- DESCRIPTION

Two synthesized sweepers provide the signals required for measuring third order intermodulation.
It is difficult when the input level is low because of being buried to the noise, to measure the spectrum generated by the distortion. Third order intermodulation distortion is raised by 20 dB if the input level is raised by 10 dB.
Then, examine with mixer input level set in -20 dBm after the spec is converted into a value which is 20dB larger.

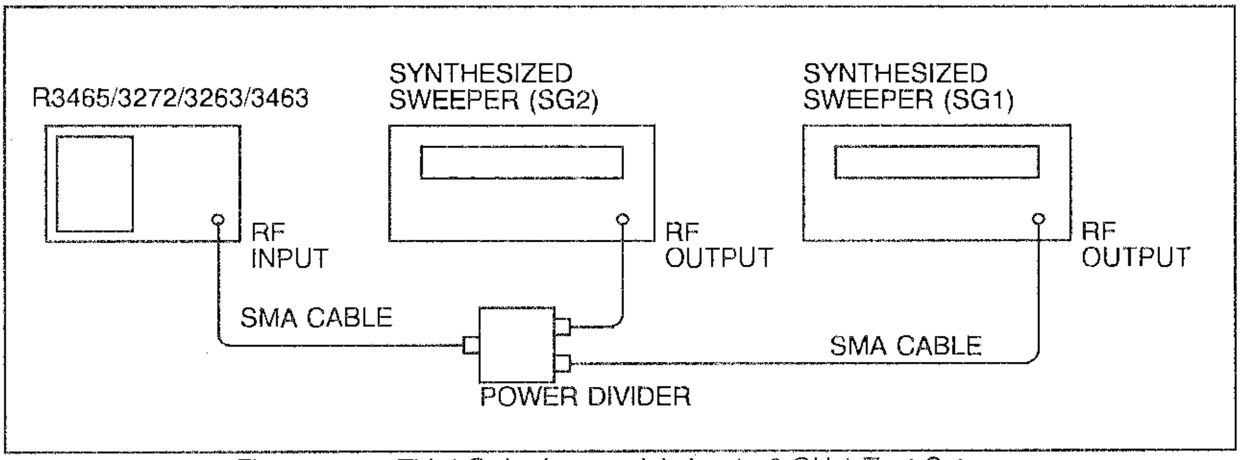


Figure 1-11 Third Order Intermodulation (<2 GHz) Test Setup

- EQUIPMENT

Synthesized Sweeper (SG1)
Synthesized Sweeper (SG2)
Power Divider #1 (Divider 1)
Power Divider #2 (Divider 2)
Cables:
SMA, 70cm (Three required)

- PROCEDURE

The following procedure carry out at -20dBm for a total mixer input level.

[Third Order Intermodulation (<2 GHz)]

(1) Select Divider 1 and connect the units as shown in Figure 1-11.

(2) Press the INSTR PRESET key on each synthesized sweeper. Set each of the synthesized sweeper controls as follows:

Power Level	− 10 dBm
CW (SG1)	820.0125 MHz
CW (SG2)	820.000 MHz
RF Output	OFF

(3) On the R3465/3272/3263/3463, press the SHIFT and PRESET keys. Set the R3465/3272/3263/3463 controls as follows:

Center Frequency	820.005 MHz
Ref Level	−10 dBm
Freq Span	50 kHz
RBW	300 Hz
VBW	300 Hz
ATT	10 dB

(4) On the SG1, set the output to ON.

(5) On the R3465/3272/3263/3463, press the MARKER [ON], [Peak] and [CONT Peak ON OFF] to set the CONT Peak to ON.

(6) On the SG1, adjust the [POWER LEVEL] key for a − 10 dBm ± 0.1 dB reading on the R3465/3272/3263/3463 display.

(7) On the SG1, set the output to OFF. On the SG2, set the output to ON.

(8) On the SG2, adjust the [POWER LEVEL] key for a -10 dBm ± 0.1 dB reading on the R3465/3272/3263/3463 display.

(9) On the SG1, set the output to ON.

(10) On the R3465/3272/3263/3463, press the following keys: [CONT Peak ON OFF] to set the CONT Peak to OFF and the [SINGLE] keys.
Wait for a new sweep to finish.

Press the [SRCH], MARKER [ON] and [Delta MKR] keys.

(11) Third order intermodulation distortions appear symmetrically 12.5 kHz apart from the two carriers. Move MKR to each distorted position with the knob or [⇧] key, read the level in dBc and record the greater reading.

[Third Order Intermodulation, 3.2 GHz (R3465/3272)]

(12) Change Divider 1 to 2.

(13) Press the [INSTR PRESET] key on each synthesized sweeper. Set each of the synthesized sweeper controls as follows:

Power Level	− 10 dBm
CW (SG1)	3.2000125 GHz
CW (SG2)	3.2 GHz
RF Output	OFF

(14) On the R3465/3272, press the SHIFT and PRESET keys. Set the R3465/3272 controls as follows:

Center Frequency .... 3.200005 GHz
Ref Level .... – 10 dBm
Span .... 50 kHz
RBW .... 300 Hz
ATT .... 10 dB
VBW .... 300 HZ

(15) Repeat steps (4) to (11) to measure the third order intermodulation distortions and record the greater reading.

Table 1-13 Third Order Intermodulation Distortion

SG1 [CW] (MHz)	SG2 [CW] (MHz)	Third Order Intermodulation Distortion	
		Actual (dBc)	Max (dBc)
820.0125	820		-55
3200.0125	3200		-55

1.4.12 Image, Multiple and Out-of-Band Response

- SPECIFICATION

Image, Multiple and Out-of-Band Response:

R3465: −70 dBc (10 MHz to 8 GHz)

R3272:
- −70 dBc (10 MHz to 18 GHz)
- −60 dBc (10 MHz to 23 GHz)
- −50 dBc (10 MHz to 26.5 GHz)

Image and Multiple Response:

R3263/3463: −70 dBc (10 MHz to 3 GHz)

- RELATED ADJUSTMENT
YTF adjustment

- DESCRIPTION
The performance tests in the R3465, R3272 and R3263/3463 differ in measurement frequency. Make measurement with each band.

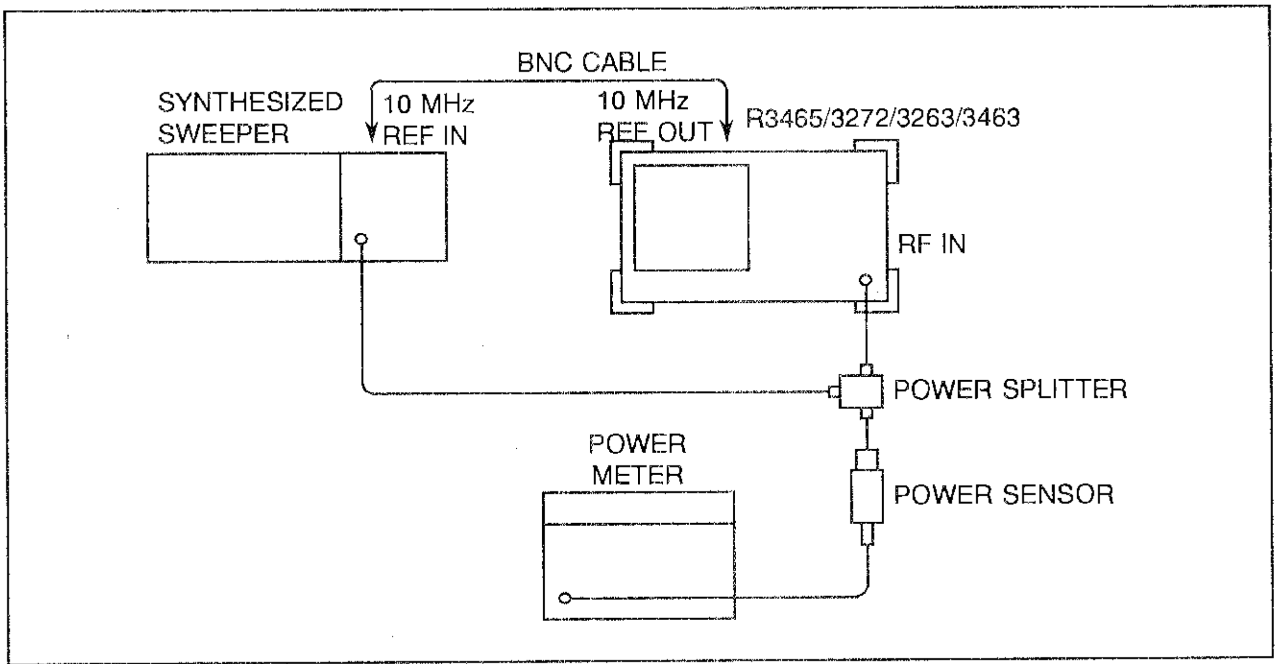


Figure 1-12 Image, Multiple and Out-of-Band Response Test Setup

- EQUIPMENT

Synthesized Sweeper (SG3)
Power Meter
Power Sensor (Sensor 1)
Power Splitter
Adapter:
  Type N to SMA
Cable:
  SMA, 70 cm

- PROCEDURE

[9 kHz to 3.0 GHz Band (R3465/3272/3263/3463)]

(1) Connect the equipment as shown in Figure 1-12, but do not connect the power sensor.

(2) Press the INSTR PRESET key on the SG3 and set the controls as follows:

CW	2 GHz
Power Level	0 dBm

(3) On the R3465/3272/3263/3463, press the SHIFT, PRESET keys and set the controls as follows:

Center Frequency	2 GHz
Span	40 MHz
RBW	100 kHz
VBW	300 Hz

(4) Zero and calibrate the power meter. Rotate the CAL FACTOR switch to the power sensor's 2 GHz calibration factor.
Connect the power sensor to the power splitter.

(5) Adjust the SG3 POWER LEVEL key for a 0 dBm ±0.1 dB reading on the power meter.

(6) For the R3465, press FREQ, more 1/2 and Preselector 1.7G 3.0G to set the preselector to 3.0 GHz.

(7) On the R3465/3272/3263/3463, press SPAN, 5, MHz, SINGLE, SRCH, MARKER ON, Delta MKR and FIXED MKR ON OFF to set the FIXED MKR to ON.

(8) For each of the frequencies listed in Table 1-14, 1-15 and 1-16 (Table1-14: R3272, Table 1-15: R3465, Table 1-16: R3263/3463) for the 9 kHz to 3.1 GHz band, do the following:

① Set the SG3 to the listed CW key frequency.

② On the power meter, rotate the CAL FACTOR switch to the appropriate power sensor calibration factor.

③ Set the SG3 POWER LEVEL key for a 0 dBm reading on the power meter.

④ Press SINGLE key on the R3465/3272/3263/3463.

⑤ On the R3465/3272/3263/3463, press SRCH key and record the ΔMKR amplitude in Table 1-14, 1-15 and 1-16 as the response amplitude. The response amplitude should be less than the specification listed in the table.

(9) On the R3465/3272/3263/3463, press the MARKER ON, MKR OFF and REPEAT keys.

Measurement frequency for the R3465 is different for the following bands. Therefore, skip steps (10) to (28) and restart from step (29). The following steps are for the R3272.

[3.0 to 7.5 GHz Band (R3272 Only)]

(10) On the R3272, press FREQ , 5 , . , 5 and GHz keys. Set the SG3 CW to 5.5 GHz.

(11) Rotate the CAL FACTOR switch to the power sensor's 5.5 GHz calibration factor on the power meter.

(12) On the SG3, set the power level to the power meter indicate 0dBm.
On the R3272, press SPAN , 5 , MHz , SRCH , FREQ , more 1/2 , PRESELE and AUTO PEAKING keys. Wait for the "peaking!!" message to disappear.

Press SINGLE, SRCH, MARKER ON , Delta MKR and FIXED MKR ON OFF to set the FIXED MKR to ON.

(13) Repeat steps (8) and (9) for the SG3 frequencies listed in Table 1-14 for the 3.0 GHz to 7.5 GHz band.

[7.4 GHz to 15.4 GHz Band (R3272 Only)]

(14) On the R3272, press the FREQ , 1 , 2 and GHz keys. Set the SG3 CW to 12 GHz.

(15) Rotate the CAL FACTOR switch to the power sensor's 12 GHz calibration factor on the power meter.

(16) Repeat step (12) for the R3272.

(17) Repeat steps (8) and (9) for the SG3 frequencies listed in Table 1-14 for the 7.4 GHz to 15.4 GHz band.

[15.2 GHz to 23.3 GHz Band (R3272 Only)]

(18) On the R3272, press the FREQ , 2 , 1 and GHz keys. Set the SG3 CW to 21 GHz.

(19) Rotate the CAL FACTOR switch to the power sensor's 21 GHz calibration factor on the power meter.

(20) Repeat step (12) for the R3272.

(21) Repeat steps (8) and (9) for the sweeper frequencies listed in Table 1-14 for the 15.2 to 23.3 GHz band.

[23 to 26.5 GHz Band (R3272 Only)]

(22) On the R3272, press the FREQ , 2 , 4 , . , 4 and GHz keys. Set the SG3 CW to 24.4 GHz.

(23) Rotate the CAL FACTOR switch to the power sensor's 24.4 GHz calibration factor on the power meter.

(24) Repeat step (12) for the R3272.

(25) Repeat steps (8) and (9) for the SG3 frequencies listed in Table 1-14 for the 23 to 26.5 GHz band.

(26) Record the maximum response amplitude from Table 1-14.
(At frequency less than 18 GHz)

Maximum Response Amplitude (<18 GHz)__________dBc

(27) Record the maximum response amplitude from Table 1-14.
(At frequency ranging from 18 to 23 GHz)

Maximum Response Amplitude(<23 GHz) __________dBc

(28) Record the maximum response amplitude from Table 1-14.
(At frequency ranging from 23 to 26 GHz)

Maximum Response Amplitude(< 26.5GHz) __________dBc

The following steps are for the R3465.

[1.7 to 8 GHz Band (R3465 Only)]

(29) Press [FREQ], [more 1/2] and [Preselector 1.7G 3.0G] keys to set the preselector to 1.7 GHz.

(30) On the R3465, press [FREQ], [6] and [GHz] keys. Set the SG3 [CW] to 6 GHz.

(31) Rotate the CAL FACTOR switch to the power sensor's 6 GHz calibration factor on the power meter.

(32) On the SG3, set the power level to the power meter indicate 0dBm.
On the R3465, press [SPAN], [5], [MHz], [SRCH], [FREQ], [more 1/2] and [AUTO PEAKING] keys. Wait for the "peaking!!" message to disappear.

Press [SINGLE], [SRCH], [MARKER ON], [Delta MKR] and [FIXED MKR ON OFF] keys to set the FIXED MKR to ON.

(33) Repeat steps (8) and (9) for the SG3 frequency listed in Table 1-15 for the 1.7 to 8 GHz band's 6 GHz center frequency.

(34) On the R3465, press [FREQ], [8] and [GHz] keys. Set the SG3 [CW] to 8 GHz.

(35) Rotate the CAL FACTOR switch to the power sensor's 8 GHz calibration factor on the power meter.

(36) Repeat step (32) for the R3465.

(37) Repeat steps (8) and (9) for the SG3 frequencies listed in Table 1-15 for the 1.7 to 8 GHz band's 8 GHz center frequency.

(38) Record the maximum response amplitude from Table 1-15.

Maximum Response Amplitude __________dBc

Table 1-14 Image, Multiple and Out-of-Band Responses (R3272)

Band	R3272 Center Freq. (GHz)	SG CW (MHz)	Response Amplitude (dBc)	Specification (dBc)
9 kHz to 3.1 GHz Band	2.0	1957.2		−70
	2.0	1157.2		−70
	2.0	10462.8		−70
	2.0	8231.4		−70
3.0 GHz to 7.5 GHz Band	5.5	6342.8		−70
	5.5	11421.4		−70
	5.5	17342.8		−70
	5.5	23264.2		−50
7.4 GHz to 15.4 GHz Band	12.0	12842.8		−70
	12.0	5789.3		−70
	12.0	18210.7		−60
	12.0	24421.4		−50
15.2 GHz to 23.3 GHz Band	21.0	21842.8		−60
	21.0	6719.06		−70
	21.0	13859.53		−70
23 GHz to 26.5 GHz Band	24.4	25242.8		−60
	24.4	5783.95		−70
	24.4	11989.3		−70
	24.4	18194.65		−60

Table 1-15 Image, Multiple and Out-of-Band Responses (R3465)

Band	R3465 Center Freq. (GHz)	SG CW (MHz)	Response Amplitude (dBc)	Specification (dBc)
9 kHz to 3.0 GHz Band	2.0	1957.2		−70
	2.0	1157.2		−70
	2.0	10462.8		−70
	2.0	8231.4		−70
1.7 GHz to 8 GHz Band	6.0	6842.8		−70
	8.0	4632.1		−70
	8.0	3789.3		−70

Table 1-16 Image and Multiple Responses (R3263/3463)

Band	R3263/3463 Center Freq. (GHz)	SG CW (MHz)	Response Amplitude (dBc)	Specification (dBc)
9 kHz to 3.0 GHz Band	2.0	1957.2		−70
	2.0	1157.2		−70

1.4.13 Frequency Response

- SPECIFICATION

R3465:
- ± 1.5 dB (9 kHz to 3.0 GHz) (10 dB Input Attenuator)
- ± 1.0 dB (50 MHz to 3.0 GHz)
- ± 1.5 dB (1.7 GHz to 7.0 GHz)
- ± 1.5 dB (6.9 GHz to 8 GHz)

R3272:
- ± 1.5 dB (9 kHz to 3.1 GHz)
- ± 1.0 dB (50 MHz to 3.1 GHz)
- ± 1.5 dB (3.0 GHz to 7.5 GHz)
- ± 3.5 dB (7.4 GHz to 15.4 GHz)
- ± 4.0 dB (15.4 GHz to 23.3 GHz)
- ± 4.0 dB (23 GHz to 26.5 GHz)

R3263/3463:
- ± 1.5 dB (9 kHz to 3.0 GHz)
- ± 1.0 dB (50 MHz to 3.0 GHz)

Frequency response relative to the calibrator (30 MHz):

R3465:	± 3 dB (9 kHz to 8 GHz)
R3272:	± 5 dB (9 kHz to 26.5 GHz)
R3263/3463:	± 2 dB (9 kHz to 3 GHz)

- RELATED ADJUSTMENT

YTF adjustment.
Frequency response adjustment.

- DESCRIPTION

The SG3 signal is fed through a power splitter to a power sensor and the R3465/3272/3263/3463. The SG3's power level is adjusted at 30 MHz to place the displayed signal at the R3465/3272/3263/3463 center horizontal graticule line. The power meter is placed in RATIO mode. At each new SG3 frequency, the SG3's power level is adjusted to the center horizontal graticule line. The power meter displays the inverse of the frequency response relative to the calibrator.

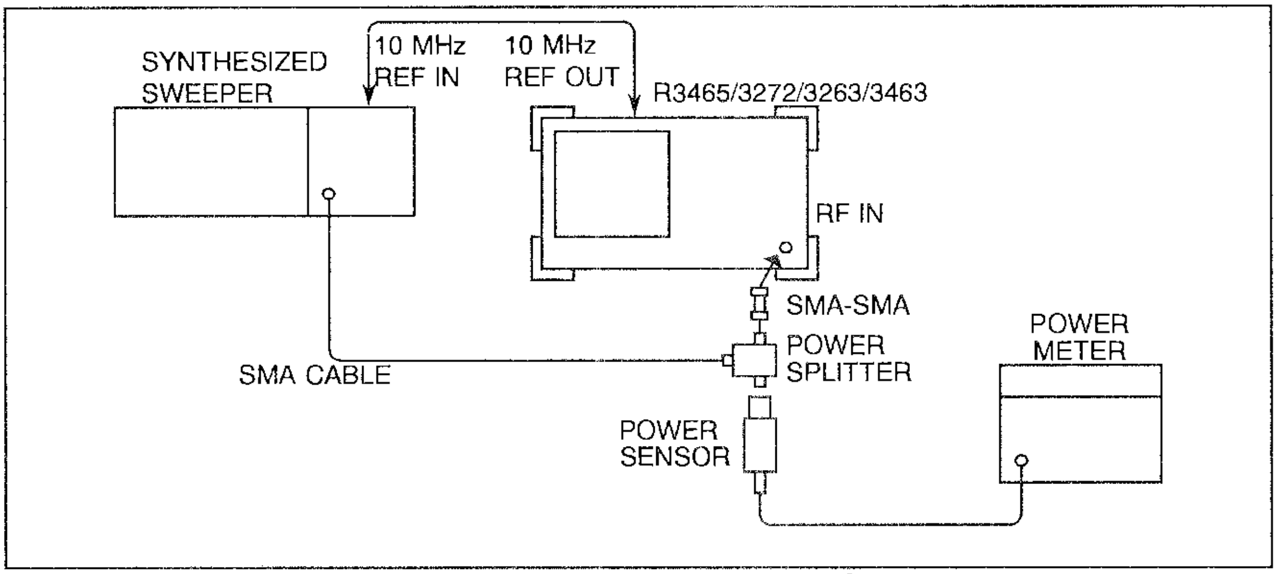


Figure 1-13 Frequency Response Test Setup

- EQUIPMENT

Synthesized Sweeper (SG3)
Power Meter
Power Sensor (Sensor 1)
Power splitter
Adapter:
  Type N to SMA
  SMA (m) to SMA (m)
Cables:
  SMA, 70 cm (Two required)

- PROCEDURE

(1) Zero and calibrate the power meter.

(2) Connect the equipment as shown in Figure 1-13.

(3) Press the INSTR PRESET key on the SG3. Set the SG3 controls as follows:

CW .... 30 MHz
Freq Step .... 100 MHz
Power Level .... −4 dBm

(4) On the R3465/3272/3263/3463, press the SHIFT [ ] and PRESET [ ] keys.

Center Frequency	30 MHz
CF Step	100 MHz
Span	5 MHz
Ref Level	−5 dBm
dB/div	2 dB/div
RBW	300 kHz
VBW	100 Hz
Trace Detector	Posi

(5) Press MARKER [ON], [Peak] and [CONT Peak ON OFF] keys to set the CONT PEAK to ON.

(6) Adjust the SG3 POWER LEVEL for a MKR amplitude reading of −10 dBm ±0.09 dB.

(7) Press the [dB [REF]] switch on the power meter.

[Frequency Response (R3465/3272/3263/3463: 9 kHz to 3.0 GHz Band)]

(8) Set the SG3 [CW] to 100 MHz.

(9) For the R3465, press [FREQ], [more 1/2] and [Preselector 1.7G 3.0G] to set the preselector to 3.0 GHz.

(10) On the R3465/3272/3263/3463, press [FREQ], [1], [0], [0] and [MHz] keys.

(11) Adjust the SG3 POWER LEVEL for an R3465/3272/3263/3463 MKR amplitude reading of −10 dBm ±0.09 dB.

(12) Record the reverse sign value of the power ratio displayed on the power meter in Table 1-17.

(13) On the SG3, press the [CW] and up keys.
On the R3465/3272/3263/3463, press the [FREQ] and [⇧] keys.
At each new frequency, repeat steps (11) and (12), rotating the CAL FACTOR switch to the power sensor's calibration factor.

[Frequency Response (R3465: 1.7 to 7.0 GHz Band) (R3272: 3.0 to 7.5 GHz Band)]

(14) For the R3465, press [FREQ], [more 1/2] and [Preselector 1.7G 3.0G] to set the preselector to 1.7 GHz.

(15) On the R3465/3272, press [FREQ], [1], [.], [8] and [GHz] keys.
([3], [.], [1] for R3272)

(16) Set the SG3 [CW] to 1.8 GHz. (3.1 GHz for R3272)

(17) On the R3465/3272, press [SRCH], [FREQ], [more 1/2], [PRESELE] and [AUTO PEAKING] keys.
Wait for the "peaking!!" message to disappear.

(18) Adjust the SG3 POWER LEVEL for an R3465/3272 MKR amplitude reading of −10 dBm ±0.09 dB.

(19) Record the reverse sign value of the power ratio displayed on the power meter in Table 1-18 and 1-19.

(20) On the SG3, press the [CW] and up keys.
On the R3465/3272, press the [FREQ] and [⇧] keys.
At each new frequency, repeat steps (17) through (19), rotating the CAL FACTOR switch to the power sensor's calibration factor.

[Frequency Response (R3465: 6.9 to 8.0 GHz Band) (R3272: 7.4 to 15.4 GHz Band)]

(21) On the R3465/3272, press FREQ, 7, ., 0 and GHz keys.
(7, ., 5 for R3272)

Press FREQ and CF STEP AUTO MNL to set the CF STEP to MNL.

Press 2, 0, 0 and MHz keys.

(22) Set the SG3 CW to 7.0 GHz (7.5 GHz for R3272) and CF STEP SIZE to 200 MHz.

(23) On the R3465/3272, press SRCH, FREQ, more 1/2, PRESELE and AUTO PEAKING keys.
Wait for the "peaking!!" message to disappear.

(24) Adjust the SG3 POWER LEVEL for an R3465/3272 MKR amplitude reading of −10 dBm ±0.09 dB.

(25) Recording the reverse sign value of the power ratio displayed on the power meter in Table 1-20 and 1-21.

(26) On the SG3, press the CW and up keys.
On the R3465/3272, press the FREQ and ⇧ keys.
At each new frequency, repeat steps (23) through (25), rotating the CAL FACTOR switch to the power sensor's calibration factor.

[Frequency Response (R3272: 15.2 to 23.3 GHz Band)]

(27) On the R3272, press FREQ, 1, 5, ., 4 and GHz keys.

(28) Set the SG3 CW to 15.4 GHz.

(29) On the R3272, press SRCH, FREQ, more 1/2, PRESELE and AUTO PEAKING keys.
Wait for the "peaking!!" message to disappear.

(30) Adjust the SG3 POWER LEVEL for an R3272 MKR amplitude reading of −10 dBm ±0.09 dB.

(31) Record the negative value of the power ratio displayed on the power meter in Table 1-22.

(32) On the SG3, press the [CW] and up keys.
On the R3272, press the [FREQ] and [△] keys.
At each new frequency, repeat steps (29) through (31), rotating the CAL FACTOR switch to the power sensor's calibration factor.

[Frequency Response (R3272:23 to 26.5 GHz Band)]

(33) On the R3272, press [FREQ], [2], [3], [.], [4] and [GHz] keys.

(34) Set the SG3 [CW] to 23.4 GHz.

(35) On the R3272, press [SRCH], [FREQ], [more 1/2], [PRESELE] and [AUTO PEAKING] keys.
Wait for the "peaking!!" message to disappear.

(36) Adjust the sweeper POWER LEVEL for an R3272 MKR amplitude reading of −10 dBm ±0.09 dB.

(37) Record the reverse sign value of the power ratio displayed on the power meter in Table 1-23.

(38) On the SG3, press the [CW] and up keys.
On the R3272, press the [FREQ] and [△] keys.
At each new frequency, repeat steps (35) through (37), rotating the CAL FACTOR switch to the power sensor's calibration factor.

[Test Results]

(40) Frequency Response (R3465/3272/3263/3463:9 kHz to 3.0 GHz Band)

① Enter the most positive number from Table 1-17, Power Meter Reading :________dB
The absolute value of this number should be less than 5 dB.

② Enter the most negative number from Table 1-17, Power Meter Reading:________dB
The absolute value of this number should be less than 5 dB.

③ Subtract ② from ①: __________dB
The result should be less than 3 dB.

(41) Frequency Response (R3465/3272/3263/3463:50 MHz to 3.0 GHz Band)

① Enter most positive number from Table 1-17, Power Meter Reading within the range of 100 MHz to 3.0 GHz frequency: __________dB

② Enter most negative number from Table 1-17, Power Meter Reading within the range of 100 MHz to 3.0 GHz frequency: __________dB

③ Subtract ② from ①: __________dB
The result should be less than 2 dB.

(42) Frequency Response (R3465: 1.7 GHz to 7.0 GHz Band)
(R3272: 3.0 GHz to 7.5 GHz Band)

① Enter the most positive number from Table 1-18 and 1-19, Power Meter Reading:
__________dB
The absolute value of this number should be less than 5 dB.

② Enter the most negative number from Table 1-18 and 1-19, Power Meter Reading:
__________dB
The absolute value of this number should be less than 5 dB.

③ Subtract ② from ①: __________dB
The result should be less than 3 dB.

(43) Frequency Response (R3465:6.9 to 8 GHz Band)(R3271:7.4 to 15.4 GHz Band)

① Enter the most positive number from Table 1-20 and 1-21, Power Meter Reading: ________dB
The absolute value of this number should be less than 5 dB.

② Enter the most negative number from Table 1-20 and 1-21, Power Meter Reading: ________dB
The absolute value of this number should be less than 5 dB.

③ Subtract ② from ①: ________dB
The result should be less than 7 dB (R3465:3 dB).

(44) Frequency Response (R3272:15.2 to 23.3 GHz Band)

① Enter the most positive number from Table 1-22, Power Meter Reading:________dB
The absolute value of this number should be less than 5 dB.

② Enter the most negative number from Table 1-22, Power Meter Reading:________dB
The absolute value of this number should be less than 5 dB.

③ Subtract ② from ①: ________dB
The result should be less than 8 dB.

(45) Frequency Response (R3272:23 to 26.5 GHz Band)

① Enter the most positive number from Table 1-23, Power Meter Reading:________dB
The absolute value of this number should be less than 5 dB.

② Enter the most negative number from Table 1-23, Power Meter Reading:________dB
The absolute value of this number should be less than 5 dB.

③ Subtract ② from ①: ________dB
The result should be less than 8 dB.

Table 1-17 Frequency Response
(R3465/3272/3263/3463 : 9 kHz to 3.0 GHz Band)

Column 1	Column 2	Column 3
Frequency (MHz)	Power Meter Reading (dB)	CAL Factor Freq. (GHz)
100		0.05
200		0.05
300		0.05
400		0.05
500		0.05
600		0.05
700		0.05
800		0.05
900		0.05
1000		1.0
1100		1.0
1200		1.0
1300		1.0
1400		1.0
1500		1.0
1600		1.0
1700		1.0
1800		1.0
1900		1.0
2000		2.0
2100		2.0
2200		2.0
2300		2.0
2400		2.0
2500		2.0
2600		2.0
2700		2.0
2800		2.0
2900		2.0
3000		3.0

Table 1-18 Frequency Response (R3465 : 1.7 GHz to 7.0 GHz Band)

Column 1	Column 2	Column 3
Frequency (GHz)	Power Meter Reading (dB)	CAL Factor Freq. (GHz)
1.7		1.0
1.8		1.0
1.9		1.0
2.0		2.0
2.1		2.0
2.2		2.0
2.3		2.0
2.4		2.0
2.5		2.0
2.6		2.0
2.7		2.0
2.8		2.0
2.9		2.0
3.0		3.0
3.1		3.0
3.2		3.0
3.3		3.0
3.4		3.0
3.5		3.0
3.6		3.0
3.7		3.0
3.8		3.0
3.9		3.0
4.0		4.0
4.1		4.0
4.2		4.0
4.3		4.0
4.4		4.0
4.5		4.0
4.6		4.0
4.7		4.0
4.8		4.0
4.9		4.0
5.0		5.0
5.1		5.0
5.2		5.0
5.3		5.0
5.4		5.0
5.5		5.0
5.6		5.0
5.7		5.0
5.8		5.0

Column 1	Column 2	Column 3
Frequency (GHz)	Power Meter Reading (dB)	CAL Factor Freq. (GHz)
5.9		5.0
6.0		6.0
6.1		6.0
6.2		6.0
6.3		6.0
6.4		6.0
6.5		6.0
6.6		6.0
6.7		6.0
6.8		6.0
6.9		6.0
7.0		7.0

Table 1-19 Frequency Response
(R3272 : 3.0 GHz to 7.5 GHz Band)

Column 1	Column 2	Column 3
Frequency (GHz)	Power Meter Reading (dB)	CAL Factor Freq. (GHz)
3.0		3.0
3.1		3.0
3.2		3.0
3.3		3.0
3.4		3.0
3.5		3.0
3.6		3.0
3.7		3.0
3.8		3.0
3.9		3.0
4.0		4.0
4.1		4.0
4.2		4.0
4.3		4.0
4.4		4.0
4.5		4.0
4.6		4.0
4.7		4.0
4.8		4.0
4.9		4.0
5.0		5.0
5.1		5.0
5.2		5.0
5.3		5.0
5.4		5.0
5.5		5.0
5.6		5.0
5.7		5.0
5.8		5.0
5.9		5.0
6.0		6.0
6.1		6.0
6.2		6.0
6.3		6.0
6.4		6.0
6.5		6.0
6.6		6.0
6.7		6.0
6.8		6.0
6.9		6.0
7.0		7.0
7.1		7.0
7.2		7.0
7.3		7.0
7.4		7.0

Table 1-20 Frequency Response
(R3465 : 6.9 GHz to 8 GHz Band)

Column 1	Column 2	Column 3
Frequency (GHz)	Power Meter Reading (dB)	CAL Factor Freq. (GHz)
6.9		6.0
7.1		7.0
7.3		7.0
7.5		7.0
7.7		7.0
7.9		7.0

Table 1-21 Frequency Response
(R3272 : 7.4 GHz to 15.4 GHz Band)

Column 1	Column 2	Column 3
Frequency (GHz)	Power Meter Reading (dB)	CAL Factor Freq. (GHz)
7.5		7.0
7.7		7.0
7.9		7.0
8.1		8.0
8.3		8.0
8.5		8.0
8.7		8.0
8.9		8.0
9.1		9.0
9.3		9.0
9.5		9.0
9.7		9.0
9.9		9.0
10.1		10.0
10.3		10.0
10.5		10.0
10.7		10.0
10.9		10.0
11.1		11.0
11.3		11.0
11.5		11.0
11.7		11.0
11.9		11.0
12.1		12.0
12.3		12.0
12.5		12.0
12.7		12.0
12.9		12.0
13.1		13.0
13.3		13.0
13.5		13.0
13.7		13.0
13.9		13.0
14.1		14.0
14.3		14.0
14.5		14.0
14.7		14.0
14.9		14.0
15.1		15.0
15.3		15.0

Table 1-22 Frequency Response
(R3272 : 15.2 GHz to 23.3 GHz Band)

Column 1	Column 2	Column 3
Frequency (GHz)	Power Meter Reading (dB)	CAL Factor Freq. (GHz)
15.4		15.0
15.6		15.0
15.8		15.0
16.0		16.0
16.2		16.0
16.4		16.0
16.6		16.0
16.8		16.0
17.0		17.0
17.2		17.0
17.4		17.0
17.6		17.0
17.8		17.0
18.0		18.0
18.2		18.0
18.4		18.0
18.6		18.0
18.8		18.0
19.0		19.0
19.2		19.0
19.4		19.0
19.6		19.0
19.8		19.0
20.0		20.0
20.2		20.0
20.4		20.0
20.6		20.0
20.8		20.0
21.0		21.0
21.2		21.0
21.4		21.0
21.6		21.0
21.8		21.0
22.0		22.0
22.2		22.0
22.4		22.0
22.6		22.0
22.8		22.0
23.0		23.0
23.2		23.0

Table 1-23 Frequency Response
(R3272 : 23 GHz to 26.5 GHz Band)

Column 1	Column 2	Column 3
Frequency (GHz)	Power Meter Reading (dB)	CAL Factor Freq. (GHz)
23.4		23.0
23.6		23.0
23.8		23.0
24.0		24.0
24.2		24.0
24.4		24.0
24.6		24.0
24.8		24.0
25.0		25.0
25.2		25.0
25.4		25.0
25.6		25.5
25.8		25.5
26.0		26.0
26.2		26.0
26.4		26.0

1.4.14 IF Gain Uncertainty

- SPECIFICATION

IF Gain Uncertainty:

< ±0.5 dB, reference levels 0 dBm to −50 dBm with 10 dB input attenuation

- RELATED ADJUSTMENT

IF amplitude adjustment.

- DESCRIPTION

This test measures IF gain error in resolution band width 10 kHz and 3 kHz. The input signal level is decreased as the spectrum analyzer's reference level is decreased (IF gain increased). Since the signal level is decreased in precise steps, any error between the reference level and the signal level is caused by the analyzer's IF gain. The Synthesized Level Generator is phase-looked to the analyzer's 10 MHz reference.

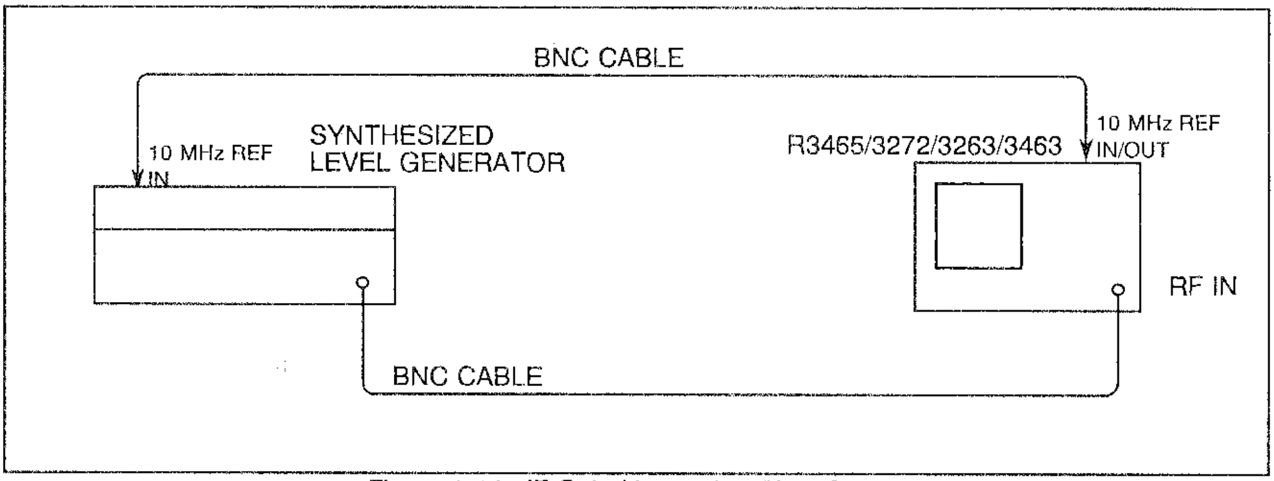


Figure 1-14 IF Gain Uncertainty Test Setup

- EQUIPMENT

Synthesized Level Generator (SG4)

Cables:

BNC, 150 cm (Two required)

- PROCEDURE

(1) Connect the equipment as shown in Figure 1-14.

(2) Set the SG4 controls as follows:

Frequency .... 30 MHz
Amplitude .... −5 dBm

(3) On the R3465/3272/3263/3463, press the SHIFT [ ] and PRESET [ ] keys and set the controls as follows:

Center Frequency .... 30 MHz
Frequency Span .... 0 Hz
REF LEVEL .... 0 dBm
dB/div .... 1 dB/div
VBW .... 1 Hz
RBW .... 10 kHz
Trace Detector .... Posi

(4) Set the output level of the SG4 to the value 5 dB lower than the R3465/3272/3263/3463 reference level.

(5) After several sweeps in the R3465/3272/3263/3463, press the [SINGLE] and [SRCH] keys to read the data on the screen and record it as the reference value. Then, press the MARKER [ON], [Delta MKR] and [FIXED MKR ON OFF] to set the FIXED MKR to ON.

(6) Lower the SG4 level and the R3465/3272/3263/3463 reference level by 1 dB. Press [SINGLE] key.

(7) Press the [SRCH] key to read the marker level on the screen and record it in Table 1-24.

(8) Repeat steps (6) and (7) until the SG4 is lowered to 10 dB.

(9) Lower the SG4 level and the R3465/3272/3263/3463 reference level by 10 dB.

(10) Press the [SRCH] key to read the data on the screen and record it in Table 1-24.

(11) Repeat steps (9) and (10) until the SG4 is lowered to 50 dB.

(12) Repeat steps (2) to (11) above for the R3465/3272/3263/3463 resolution band width 3 kHz. For resolution band width 3 kHz, record the result in Table 1-25.

Table 1-24 IF Gain Error (RBW = 10 kHz, 1 dB/div.)

Reference value (dBm)

R3465/3272/3263/3463 Reference Level (dBm)	SG4 (dBm)	Δ Marker Level (dB)	Specification
0	-5	0 (Ref.)	–
−1	-6		±0.5 dB
−2	-7		±0.5 dB
−3	-8		±0.5 dB
−4	-9		±0.5 dB
−5	-10		±0.5 dB
−6	-11		±0.5 dB
−7	-12		±0.5 dB
−8	-13		±0.5 dB
−9	-14		±0.5 dB
−10	-15		±0.5 dB
−20	-25		±0.5 dB
−30	-35		±0.5 dB
−40	-45		±0.5 dB
−50	-55		±0.5 dB

Table 1-25 IF Gain Error (RBW = 3 kHz, 1 dB/div.)

Reference value (dBm)

R3465/3272/3263/3463 Reference Level (dBm)	SG4 (dBm)	△ Marker Level (dB)	Specification
0	-5	0 (Ref.)	–
−1	-6		±0.5 dB
−2	-7		±0.5 dB
−3	-8		±0.5 dB
−4	-9		±0.5 dB
−5	-10		±0.5 dB
−6	-11		±0.5 dB
−7	-12		±0.5 dB
−8	-13		±0.5 dB
−9	-14		±0.5 dB
−10	-15		±0.5 dB
−20	-25		±0.5 dB
−30	-35		±0.5 dB
−40	-45		±0.5 dB
−50	-55		±0.5 dB

1.4.15 Scale Fidelity

- SPECIFICATION

Log Scale Fidelity: ± 0.2 dB/1 dB,
± 1 dB/10 dB to a maximum of ± 1.5 dB over 0 to 80 dB range.
Linear Scale Fidelity: < ± 15% of reference level

- RELATED ADJUSTMENT
IF amplitude adjustment.

- DESCRIPTION
This test measures display accuracy for 1 dB, 10 dB log scales, X1 linear scales. All scales are measured with 0 dBm reference signal. Figure 1-15 illustrates the measurement system of this test. The Synthesized Level Generator is phase-locked to the 10 MHz reference source of the spectrum analyzer.

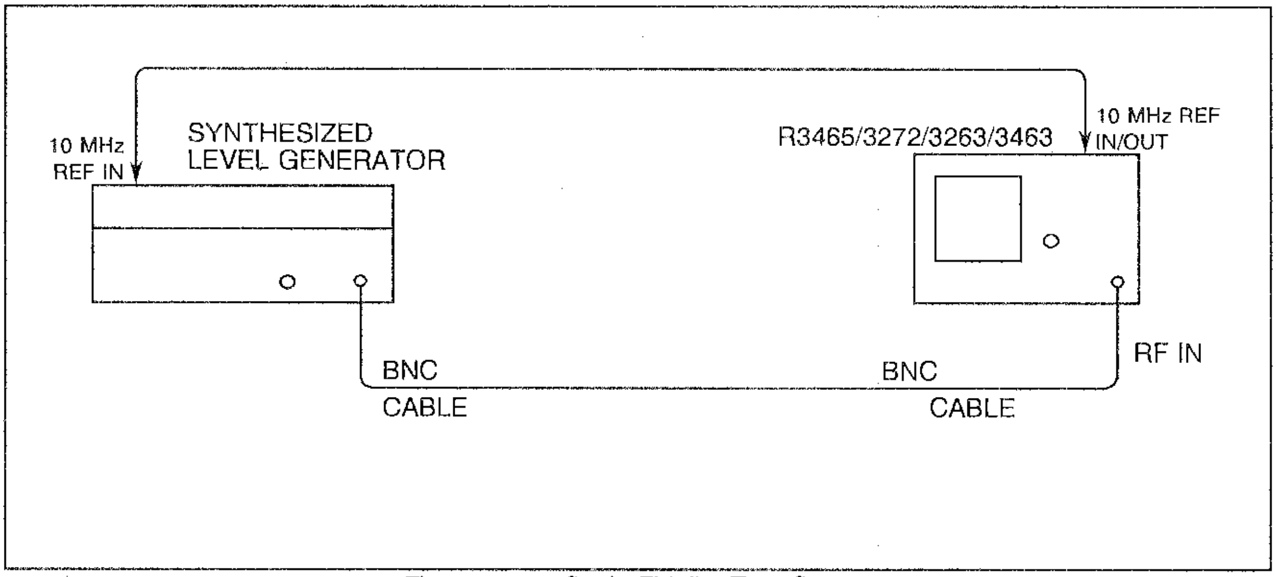


Figure 1-15 Scale Fidelity Test Setup

- EQUIPMENT

Synthesized Level Generator (SG4)
Cables:
BNC, 150 cm (Two required)

- PROCEDURE

(1) Connect the equipment as shown in Figure 1-15.

(2) Set the SG4 controls as follows:

Frequency	30 MHz
Amplitude	0 dBm

(3) On the R3465/3272/3263/3463, press the SHIFT [ ] and PRESET [ ] keys and set the controls as follows:

Center Frequency	30 MHz
Freq Span	0 Hz
Ref Level	0 dBm
RBW	3 kHz
VBW	1 Hz
dB/div	1 dB/div
Trace Detector	Posi

(4) On the R3465/3272/3263/3463, press the MARKER [ON].

[1 dB/div Log Scale]

(5) On the SG4, adjust the amplitude until the R3465/3272/3263 marker reads exactly 0.00 dBm.

(6) On the R3465/3272/3263/3463, press the FORMAT [ ], [Trace], [Trace B] and [Store B] keys.

(7) On the R3465/3272/3263/3463, press the MARKER [ON], [more 1/3], [more 2/3], [Trace MKR Move], [more 3/3], [Delta MKR], [more 1/3], [more 2/3] and [Trace MKR Move] keys.

(8) On the R3465/3272/3263/3463, press the [SINGLE] key.

(9) Lower the SG4 level by 1 dB.

(10) On the R3465/3272/3263/3463, press the [SINGLE] key.

(11) Record the Delta marker level in the Actual column in Table 1-26. Calculate the incremental error according to the following equation and record the result in the Incremental Error column in Table 1-26.

Incremental error = (Current Delta marker level) - (Previous Delta marker level) + 1 dB

(12) Repeat steps (9) to (11) until the SG4 level is set to the value 10 dB lower than the initially set level.

[10 dB/div Log Scale]

(13) On the R3465/3272/3263/3463, press the [REPEAT], [LEVEL], [dB/div] and [10 dB/div] keys.

(14) Set the SG4 level so that the R3465/3272/3263/3463 marker indicates just 0.00 dBm.

(15) On the R3465/3272/3263/3463, press the FORMAT [ ], [Trace], [Trace B] and [Store B] keys.

(16) On the R3465/3272/3263/3463, press the MARKER [ON], [more 1/3], [more 2/3], [Trace MKR Move], [more 3/3], [Delta MKR], [more 1/3], [more 2/3] and [Trace MKR Move] keys.

(17) Lower the SG4 level by 10 dB.

(18) On the R3465/3272/3263/3463, press the [SINGLE] key.

(19) Record the Delta marker level in the Actual column in Table 1-27. Calculate the incremental error from the following expression and record the result in the Incremental Error column in Table 1-27.

Incremental error = (Current Delta marker level) - (Previous Delta marker level) + 10 dB

(20) Repeat steps (17) to (19) until the frequency synthesizer level is set to the value 80 dB lower than the initially set level.

Table 1-26 1 dB/div. Log Scale Fidelity (RBW = 3 kHz)

Input Signal Level (dBm, nominal)	dB from Reference Level (nominal)	Δ Marker Level			Incremental Error (dB)
		Min. (dBm)	Actual (dBm)	Max. (dBm)	
0	0	0	0 (Ref.)	0	0 (Ref.)
−1	−1	−1.2		−0.8	
−2	−2	−2.4		−1.6	
−3	−3	−3.6		−2.4	
−4	−4	−4.8		−3.2	
−5	−5	−6.0		−4.0	
−6	−6	−7.2		−4.8	
−7	−7	−8.4		−5.6	
−8	−8	−9.5		−6.5	
−9	−9	−10.5		−7.5	
−10	−10	−11.5		−8.5	

Table 1-27 10 dB/div. Log Scale Fidelity (RBW = 3 kHz)

Input Signal Level (dBm, nominal)	dB from Reference Level (nominal)	Δ Marker Level			Incremental Error (dB)
		Min. (dBm)	Actual (dBm)	Max. (dBm)	
0	0	0	0 (Ref.)	0	0 (Ref.)
−10	−10	−11		−9	
−20	−20	−21.5		−18.5	
−30	−30	−31.5		−28.5	
−40	−40	−41.5		−38.5	
−50	−50	−51.5		−48.5	
−60	−60	−61.5		−58.5	
−70	−70	−71.5		−68.5	
−80	−80	−81.5		−78.5	

[Linear Scale]

(21) Set the SG4 as follows:

Frequency .... 30 MHz
Amplitude .... 0 dBm

(22) On the R3465/3272/3263/3463, press the SHIFT and PRESET keys and set the controls as follows:

Center Freq .... 30 MHz
Freq Span .... 0 kHz
Ref Level .... 0 dBm
RBW .... 3 kHz
VBW .... 1 kHz
Trace Detector .... Posi

(23) On the R3465/3272/3263/3463, press the LEVEL, LINEAR and X1 keys to select the linear X1 mode. Then, press the MARKER ON key.

(24) Precisely set the SG4 level to the R3465/3272/3263/3463 reference level while reading the marker level on the screen.

(25) On the R3465/3272/3263/3463, press the SINGLE key to set the single sweep mode.

(26) Read the level value displayed on the SG4 and set the value as the reference value (Ref). Then, set the frequency synthesizer level to the value 0.92 dB lower than the reference value.

(27) On the R3465/3272/3263/3463, perform single sweep, read the marker level and record it in Table 1-28.

(28) Set the SG4 level as shown in the Input Signal Level column in Table 1-28 sequentially and repeat step (27) for each.

Table 1-28 Linear Scale Fidelity (X1)

Input Signal Level		Div. from Reference Level	△ Marker Level		
(dB, nominal)	(mV, nominal)		Min. (mV)	Actual (mV)	Max. (mV)
0 (Ref.)	223.6	0	223.6	223.6 (Ref.)	223.6
−0.92	201.24	1	167.7		234.8
−1.94	178.88	2	145.3		212.5
−3.10	156.52	3	122.9		190.1
−4.44	134.16	4	100.6		167.7
−6.02	111.8	5	78.2		145.4
−7.96	89.44	6	55.9		122.0
−10.46	67.08	7	33.5		100.7
−13.98	44.72	8	11.1		78.3

1.4.16 Input Attenuator Accuracy

- SPECIFICATION

Input attenuator accuracy (referenced to 10 dB input attenuation, for 20 to 70 dB settings):

R3465:	9 kHz to 8 GHz:	< ±1.1 dB/10 dB step to a maximum of ±2.0 dB
R3272:	9 kHz to 12.4 GHz:	< ±1.1 dB/10 dB step to a maximum of ±2.0 dB
	12.4 GHz to 18 GHz:	< ±1.3 dB/10 dB step to a maximum of ±2.5 dB
	18 GHz to 26.5 GHz:	< ±1.8 dB/10 dB step to a maximum of ±3.5 dB
R3263/3463:	9 kHz to 3 GHz:	< ±1.1 dB/10 dB step to a maximum of ±2.0 dB

- RELATED ADJUSTMENT

There is no related adjustment procedure for this performance test.

- DESCRIPTION

This test measures the input attenuator's switching accuracy over the full 70 dB.
The number of frequency measured points is one point at 4 GHz for the R3465, one point at 1.5 GHz for the R3263/3463 and three points at 4 GHz, 15 GHz and 18 GHz for the R3272.
The synthesized sweeper is phase-locked to the spectrum analyzer's 10 MHz reference. The input attenuator switching accuracy is referenced to the 10 dB attenuator setting. Step-to-step accuracy is calculated from switching accuracy data.

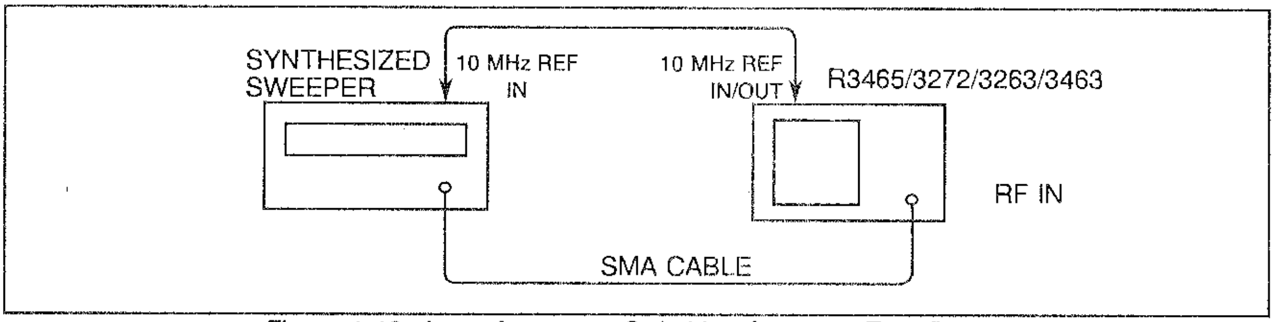


Figure 1-16 Input Attenuator Switching Accuracy Test Setup

- EQUIPMENT

Synthesized Sweeper (SG1)
Cables:
  BNC, 150cm
  SMA, 70cm

- PROCEDURE

(1) IF gain uncertainty is measured when the resolution bandwidth is set to 3kHz and the result is filled in on the IF Gain uncertainty of Table 1-29.
For the test method, refer to "1.4.14 IF Gain Uncertainty".

CAUTION

Measure IF gain uncertainty when the resolution bandwidth is set to 3 kHz before doing this test.
IF gain uncertainty is included in the measurement result because of IF gain's changing and measuring in this test.

(2) Connect the equipment as shown in Figure 1-16.

(3) Set the SG1 controls as follows:

Frequency (for the R3465/3272)	4 GHz
(for the R3263/3463)	1.5 GHz
Amplitude	-5 dBm

(4) On the R3465/3272/3263/3463, press the SHIFT [ ] and PRESET [ ] keys and set the controls as follows:

Center Frequency (for the R3465/3272)	4 GHz
(for the R3263/3463)	1.5 GHz
Frequency Span	10 kHz
Ref Level	0 dBm
dB/div	1 dB/div
RBW	3 kHz
Trace Detector	Posi

(5) On the SG4, adjust the POWER LEVEL to the value 5 dB lower than the R3465/3272/3263/3463 reference level.

(6) On the R3465/3272/3263/3463, press the [SINGLE] key.

Press the [SRCH] key, read the MKR level and record it in Table 1-29 as the reference value.

(7) On the R3465/3272/3263/3463, press the [ATT] and ATT AUTO [AUTO] [MNL] keys to set the ATT AUTO to MNL.

(8) Press the key.

(9) On the R3465/3272/3263/3463, press the SINGLE key.

Press the SRCH key, read the MKR level. The marker level measured here is subtracted from the reference value measure in the (6).
IF gain uncertainty measured in the (1) is subtracted from the value.

Records it in Table 1-29 as Actual MKR Reading.

Actual MKR Reading	=	Reference value measured in the (6)	-	Marker level measured in the (9)	-	IF gain uncertainty measured in the (1)

(10) Repeat steps (7) through (9) for the remaining R3465/3272/3263/3463 ATT setting listed in Table 1-29.

(11) Calculate the step-to-step accuracy as described in the following steps and record the results in Table 1-29. Step-to-step accuracy should be within the limits shown in Table 1-29.

[Step-to-Step Accuracy Calculation]

(12) For the 20 dB ATT setting, switching accuracy becomes step-to-step accuracy.

(13) For the 30, 40, 50, 60 and 70 dB ATT settings, subtract the 10dB down ATT switching accuracy from the current ATT switching accuracy.

(14) Center Frequency is changed to 15GHz and 18GHz and the operations in (2) to (13) are executed for R3272. Fill in the value measured in the (1) when Center Frequency is 4GHz (1.5 GHz for the R3263/3463) on the IF Gain Uncertainty Table 1-29.

Table 1-29 Input Attenuator Accuracy

[R3465] Center Frequency: 4 GHz, Reference value____dBm

R3465 Attenuator (dB)	IF Gain (dB)	IF Gain Uncertainty (dB)	Switching Accuracy			Step-to-Step Accuracy	
			Min. (dB)	Actual (dB)	Max. (dB)	Actual (dB)	Spec. (dB)
10	0	0	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)
20	10		-2		+2		±1.1
30	20		-2		+2		±1.1
40	30		-2		+2		±1.1
50	40		-2		+2		±1.1
60	50		-2		+2		±1.1
70	60		-2		+2		±1.1

[R3272] Center Frequency: 4 GHz, Reference value____dBm

R3272 Attenuator (dB)	IF Gain (dB)	IF Gain Uncertainty (dB)	Switching Accuracy			Step-to-Step Accuracy	
			Min. (dB)	Actual (dB)	Max. (dB)	Actual (dB)	Spec. (dB)
10	0	0	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)
20	10		-2		+2		±1.1
30	20		-2		+2		±1.1
40	30		-2		+2		±1.1
50	40		-2		+2		±1.1
60	50		-2		+2		±1.1
70	60		-2		+2		±1.1

[R3272] Center Frequency: 15 GHz, Reference value____dBm

R3272 Attenuator (dB)	IF Gain (dB)	IF Gain Uncertainty (dB)	Switching Accuracy			Step-to-Step Accuracy	
			Min. (dB)	Actual (dB)	Max. (dB)	Actual (dB)	Spec. (dB)
10	0	0	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)
20	10		-2.5		+2.5		±1.3
30	20		-2.5		+2.5		±1.3
40	30		-2.5		+2.5		±1.3
50	40		-2.5		+2.5		±1.3
60	50		-2.5		+2.5		±1.3
70	60		-2.5		+2.5		±1.3

(cont'd)

[R3272] Center Frequency: 18 GHz, Reference value____dBm

R3272 Attenuator (dB)	IF Gain (dB)	IF Gain Uncertainty (dB)	Switching Accuracy			Step-to-Step Accuracy	
			Min. (dB)	Actual (dB)	Max. (dB)	Actual (dB)	Spec. (dB)
10	0	0	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)
20	10		-3.5		+3.5		±1.8
30	20		-3.5		+3.5		±1.8
40	30		-3.5		+3.5		±1.8
50	40		-3.5		+3.5		±1.8
60	50		-3.5		+3.5		±1.8
70	60		-3.5		+3.5		±1.8

[R3263/3463] Center Frequency: 1.5 GHz, Reference value____dBm

R3263/3463 Attenuator (dB)	IF Gain (dB)	IF Gain Uncertainty (dB)	Switching Accuracy			Step-to-Step Accuracy	
			Min. (dB)	Actual (dB)	Max. (dB)	Actual (dB)	Spec. (dB)
10	0	0	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)	0 (Ref.)
20	10		-2		+2		±1.1
30	20		-2		+2		±1.1
40	30		-2		+2		±1.1
50	40		-2		+2		±1.1
60	50		-2		+2		±1.1
70	60		-2		+2		±1.1

1.4.17 Calibration Amplitude Accuracy

- SPECIFICATION

  Amplitude: − 10 dBm ± 0.3 dB

- RELATED ADJUSTMENT
  Calibration amplitude adjustment.

- DESCRIPTION
  The amplitude accuracy of the CALOUT signal are checked for − 10 dBm ± 0.3 dBm.

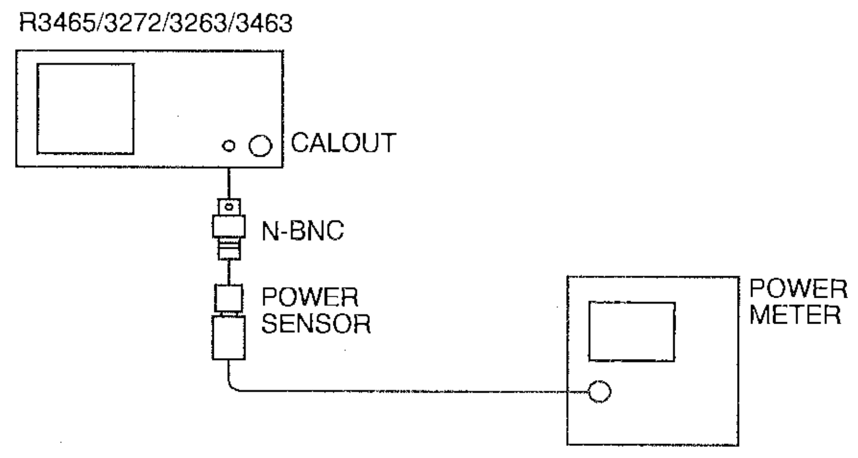


Figure 1-17 Calibration Amplitude Accuracy Test Setup

- EQUIPMENT

  Power Meter
  Power Sensor (Sensor 2)

- PROCEDURE

(1) Connect the equipment as shown in Figure 1-17.

(2) Press the power sensor zero of the power meter and calibrate the power sensor. Enter the power sensor's 30 MHz calibration factor into the power meter.

(3) Connect the power sensor via an N(f) − BNC(m) adapter directly to the CALOUT connector. Read the power meter display. The power level should be within the following limits (± 0.3 dB):

Actual
− 10.3 dBm ≤ _______ ≤ − 9.7 dBm

1.5 Checklist/Data Form

File No.	: ____________	Description	: SPECTRUM ANALYZER
UUT MFR	: ADVANTEST CO.	ID No.	: ____________
Model	: R3465/3272/3263/3463	Date	: ____________

Table 1-30 Performance Test Record (1 of 11)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
1	Frequency Readout Accuracy and Frequency Counter Marker Accuracy			
	1.5 GHz CENTER FREQ			
	1 MHz SPAN	1.499988 GHz		1.500012 GHz
	10 MHz SPAN	1.49958 GHz		1.50042 GHz
	50 MHz SPAN	1.49784 GHz		1.50216 GHz
	100 MHz SPAN	1.4958 GHz		1.4042 GHz
	2 GHz SPAN	1.419 GHz		1.581 GHz
	5.0 GHz CENTER FREQ			
	1 MHz SPAN	4.999987 GHz		5.000013 GHz
	10 MHz SPAN	4.99958 GHz		5.00042 GHz
	50 MHz SPAN	4.99784 GHz		5.00216 GHz
	100 MHz SPAN	4.9958 GHz		5.0042 GHz
	2 GHz SPAN	4.919 GHz		5.081 GHz
	<R3272 ONLY>			
	11.0 GHz CENTER FREQ			
	1 MHz SPAN	10.999987 GHz		11.000013 GHz
	10 MHz SPAN	10.99958 GHz		11.00042 GHz
	50 MHz SPAN	10.99784 GHz		11.00216 GHz
	100 MHz SPAN	10.9958 GHz		11.0042 GHz
	2 GHz SPAN	10.919 GHz		11.081 GHz
	18.0 GHz CENTER FREQ			
	1 MHz SPAN	17.999986 GHz		18.000014 GHz
	10 MHz SPAN	17.99958 GHz		18.00042 GHz
	50 MHz SPAN	17.99784 GHz		18.00216 GHz
	100 MHz SPAN	17.9958 GHz		18.0042 GHz
	2 GHz SPAN	17.919 GHz		18.081 GHz

Table 1-30 Performance Test Record (2 of 11)

Para. No.	Test Description	Results Min.	Actual	Max.
1	Frequency Readout Accuracy and Marker Frequency Counter Accuracy (cont'd)			
	Marker Frequency Counter Accuracy			
	1.5 GHz CENTER FREQ	1.499999844 GHz		1.500000156 GHz
	5.0 GHz CENTER FREQ	4.999999494 GHz		5.000000506 GHz
	11.0 GHz CENTER FREQ	10.999998889 GHz		11.000001111 GHz
	18.0 GHz CENTER FREQ	17.999998184 GHz		18.000001816 GHz
2	Frequency Reference Output Accuracy			
	10 MHz Reference Frequency	29.9999970 MHz		30.0000030 MHz
3	Noise Sidebands			
	1.5 GHz Center Frequency			
	10 kHz Offset			−100 dBc/Hz
	100 kHz Offset			−110 dBc/Hz
	<R3465/3272 ONLY>			
	3.5 GHz Center Frequency			
	10 kHz Offset			−98 dBc/Hz
	100 kHz Offset			−108 dBc/Hz
4	Frequency Span Accuracy			
	1.5 GHz Center Frequency			
	5 MHz SPAN	3.96 MHz		4.04 MHz
	5.01 MHz SPAN	3.847 MHz		4.169 MHz
	40 MHz SPAN	30.72 MHz		33.28 MHz
	400 MHz SPAN	307.2 MHz		332.8 MHz
	<R3465/3272 ONLY>			
	4.0 GHz Center Frequency			
	4 GHz SPAN	3.072 GHz		3.328 GHz
	8 GHz SPAN	6.144 GHz		6.656 GHz
	<R3272 ONLY>			
	10 GHz Center Frequency			
	10 GHz SPAN	7.68 GHz		8.32 GHz
	19 GHz SPAN	15.36 GHz		16.64 GHz

Table 1-30 Performance Test Record (3 of 11)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
5	Resolution Bandwidth Accuracy and Selectivity			
	Resolution Bandwidth Accuracy			
	5 MHz	3.50 MHz		6.5 MHz
	3 MHz	2.1 MHz		3.9 MHz
	1 MHz	800 kHz		1.2 MHz
	300 kHz	240 kHz		360 kHz
	100 kHz	80 kHz		120 kHz
	30 kHz	24 kHz		36 kHz
	10 kHz	8.0 kHz		12.0 kHz
	3 kHz	2.4 kHz		3.6 kHz
	1 kHz	800 Hz		1200 Hz
	300 Hz	210 Hz		390 Hz
	Resolution Bandwidth Selectivity			
	5 MHz			15
	3 MHz			15
	1 MHz			15
	300 kHz			15
	100 kHz			15
	30 kHz			15
	10 kHz			15
	3 kHz			15
	1 kHz			15
	300 Hz			15

Table 1-30 Performance Test Record (4 of 11)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
6	Resolution Bandwidth Switching Uncertainty			
	3 MHz	−0.3 dB		+0.3 dB
	1 MHz	−0.3 dB		+0.3 dB
	300 kHz		0 (Ref)	
	100 kHz	−0.3 dB		+0.3 dB
	30 kHz	−0.3 dB		+0.3 dB
	10 kHz	−0.3 dB		+0.3 dB
	3 kHz	−0.3 dB		+0.3 dB
	1 kHz	−0.3 dB		+0.3 dB
	300 Hz	−0.3 dB		+0.3 dB

Table 1-30 Performance Test Record (5 of 11)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
7	Displayed Average Noise Level			
	<R3465 ONLY>			
	10 kHz			−70.0 dBm
	100 kHz			−80.0 dBm
	1.1MHz			−114.99 dBm
	101 MHz			−114.84 dBm
	501 MHz			−114.22 dBm
	1001 MHz			−113.45 dBm
	1501 MHz			−112.67 dBm
	2001 MHz			−111.90 dBm
	2501 MHz			−111.12 dBm
	2999 MHz			−110.35 dBm
	1.7 GHz to 7.0 GHz			−115 dBm
	6.9 GHz to 8.0 GHz			−115 dBm
	<R3272 ONLY>			
	10 kHz			−70.0 dBm
	100 kHz			−80.0 dBm
	1.1MHz			−114.99 dBm
	101 MHz			−114.84 dBm
	501 MHz			−114.22 dBm
	1001 MHz			−113.45 dBm
	1501 Hz			−112.67 dBm
	2001 MHz			−111.90 dBm
	2501 MHz			−111.12 dBm
	2999 MHz			−110.35 dBm
	3.0 GHz to 7.5 GHz			−110.0 dBm
	7.4 GHz to 15.4 GHz			−103.0 dBm
	15.2 GHz to 23.3 GHz			−96.0 dBm
	23 GHz to 26.5 GHz			−90.0 dBm
	<R3263/3463 ONLY>			
	10 kHz			−70.0 dBm
	100 kHz			−80.0 dBm
	1.1 MHz			−114.99 dBm
	101 MHz			−114.84 dBm
	501 MHz			−114.22 dBm
	1001 MHz			−113.45 dBm
	1501 MHz			−112.67 dBm
	2001 MHz			−111.90 dBm
	2501 MHz			−111.12 dBm
	2999 MHz			−110.35 dBm

Table 1-30 Performance Test Record (6 of 11)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
8	Gain Compression			
	820.5 MHz	−5 dBm		
	<R3465/3272 ONLY> 3200.5 MHz	−5 dBm		
9	Residual Response			
	1 MHz to 3.0 GHz			−100 dBm
	<R3465 ONLY> 1.7 GHz to 8.0 GHz			−90 dBm
	<R3272 ONLY> 3.0 GHz to 26.5 GHz			−90 dBm
10	Second Harmonic Distortion INPUT FREQ: 1.4 GHz INPUT FREQ: 1.9 GHz			 −70 dBc −100 dBc
11	Third Order Intermodulation Distortion			(Mixer Input Level : -20dBm)
	820.005 MHz 3200.005 MHz			−55 dBc −55 dBc
12	Image, Multiple, and Out-of-Band Response			
	Maximum Response Amplitude			
	<R3465 ONLY> 10 MHz to 8 GHz			−70 dBc
	<R3272 ONLY> 10 MHz to 18 GHz 10 MHz to 23 GHz 10 MHz to 26.5 GHz			 −70 dBc −60 dBc −50 dBc
	<R3263/3463 ONLY> 10 MHz to 3 GHz			−70 dBc

Table 1-30 Performance Test Record (7 of 11)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
13	Frequency Response			
	<R3465 ONLY>			
	9 kHz to 3.0 GHz	−1.5 dB		+1.5 dB
	50 MHz to 3.0 GHz	−1.0 dB		+1.0 dB
	1.7 GHz to 7.5 GHz	−1.5 dB		+1.5 dB
	7.4 GHz to 8 GHz	−1.5 dB		+1.5 dB
	<R3272 ONLY>			
	9 kHz to 3.0 GHz	−1.5 dB		+1.5 dB
	50 MHz to 3.0 GHz	−1.0 dB		+1.0 dB
	3.0 GHz to 7.5 GHz	−1.5 dB		+1.5 dB
	7.4 GHz to 15.4 GHz	−3.5 dB		+3.5 dB
	15.4 GHz to 23.3 GHz	−4.0 dB		+4.0 dB
	23.0 GHz to 26.5 GHz	−4.0 dB		+4.0 dB
	<R3263/3463 ONLY>			
	9 kHz to 3.0 GHz	−1.5 dB		+1.5 dB
	50 MHz to 3.0 GHz	−1.0 dB		+1.0 dB
14	IF Gain Uncertainty			
	RBW 10 kHz REF LEVEL			
	0 dBm			
	−1 dBm	−0.5 dB		+0.5 dB
	−2 dBm	−0.5 dB		+0.5 dB
	−3 dBm	−0.5 dB		+0.5 dB
	−4 dBm	−0.5 dB		+0.5 dB
	−5 dBm	−0.5 dB		+0.5 dB
	−6 dBm	−0.5 dB		+0.5 dB
	−7 dBm	−0.5 dB		+0.5 dB
	−8 dBm	−0.5 dB		+0.5 dB
	−9 dBm	−0.5 dB		+0.5 dB
	−10 dBm	−0.5 dB		+0.5 dB
	−20 dBm	−0.5 dB		+0.5 dB
	−30 dBm	−0.5 dB		+0.5 dB
	−40 dBm	−0.5 dB		+0.5 dB
	−50 dBm	−0.5 dB		+0.5 dB

Table 1-30 Performance Test Record (8 of 11)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
14	IF Gain Uncertainty (cont'd)			
	RBW 3 kHz REF LEVEL			
	0 dBm			
	−1 dBm	−0.5 dB		+0.5 dB
	−2 dBm	−0.5 dB		+0.5 dB
	−3 dBm	−0.5 dB		+0.5 dB
	−4 dBm	−0.5 dB		+0.5 dB
	−5 dBm	−0.5 dB		+0.5 dB
	−6 dBm	−0.5 dB		+0.5 dB
	−7 dBm	−0.5 dB		+0.5 dB
	−8 dBm	−0.5 dB		+0.5 dB
	−9 dBm	−0.5 dB		+0.5 dB
	−10 dBm	−0.5 dB		+0.5 dB
	−20 dBm	−0.5 dB		+0.5 dB
	−30 dBm	−0.5 dB		+0.5 dB
	−40 dBm	−0.5 dB		+0.5 dB
	−50 dBm	−0.5 dB		+0.5 dB

Table 1-30 Performance Test Record (9 of 11)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
15	Scale Fidelity			
	1 dB/div Log Scale Fidelity			
	−1 dB	−0.2 dB		+0.2 dB
	−2 dB	−0.4 dB		+0.4 dB
	−3 dB	−0.6 dB		+0.6 dB
	−4 dB	−0.8 dB		+0.8 dB
	−5 dB	−1.0 dB		+1.0 dB
	−6 dB	−1.2 dB		+1.2 dB
	−7 dB	−1.4 dB		+1.4 dB
	−8 dB	−1.5 dB		+1.5 dB
	−9 dB	−1.5 dB		+1.5 dB
	−10 dB	−1.5 dB		+1.5 dB
	10 dB/div Log Scale Fidelity			
	−10 dB	−1.0 dB		+1.0 dB
	−20 dB	−1.5 dB		+1.5 dB
	−30 dB	−1.5 dB		+1.5 dB
	−40 dB	−1.5 dB		+1.5 dB
	−50 dB	−1.5 dB		+1.5 dB
	−60 dB	−1.5 dB		+1.5 dB
	−70 dB	−1.5 dB		+1.5 dB
	−80 dB	−1.5 dB		+1.5 dB
	Linear Scale Fidelity			
	div from Ref Level			
	1	167.7 mV		234.8 mV
	2	145.3 mV		212.5 mV
	3	122.9 mV		190.1 mV
	4	100.6 mV		167.7 mV
	5	78.2 mV		145.4 mV
	6	55.9 mV		122.0 mV
	7	33.5 mV		100.7 mV
	8	11.1 mV		78.3 mV

Table 1-30 Performance Test Record (10 of 11)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
16	Input Attenuator Accuracy			
	<R3465/3272 ONLY>			
	(4 GHz Center Freq)			
	Switching Accuracy			
	20 dB	-2 dB		+2 dB
	30 dB	-2 dB		+2 dB
	40 dB	-2 dB		+2 dB
	50 dB	-2 dB		+2 dB
	60 dB	-2 dB		+2 dB
	70 dB	-2 dB		+2 dB
	Step-to-Step Accuracy			
	20 dB	−1.1 dB		+1.1 dB
	30 dB	−1.1 dB		+1.1 dB
	40 dB	−1.1 dB		+1.1 dB
	50 dB	−1.1 dB		+1.1 dB
	60 dB	−1.1 dB		+1.1 dB
	70 dB	−1.1 dB		+1.1 dB
	<R3272 ONLY>			
	(15 GHz Center Freq)			
	Switching Accuracy			
	20 dB	-2.5 dB		+2.5 dB
	30 dB	-2.5 dB		+2.5 dB
	40 dB	-2.5 dB		+2.5 dB
	50 dB	-2.5 dB		+2.5 dB
	60 dB	-2.5 dB		+2.5 dB
	70 dB	-2.5 dB		+2.5 dB
	Step-to-Step Accuracy			
	20 dB	−1.3 dB		+1.3 dB
	30 dB	−1.3 dB		+1.3 dB
	40 dB	−1.3 dB		+1.3 dB
	50 dB	−1.3 dB		+1.3 dB
	60 dB	−1.3 dB		+1.3 dB
	70 dB	−1.3 dB		+1.3 dB
	(18 GHz Center Freq)			
	Switching Accuracy			
	20 dB	-3.5 dB		+3.5 dB
	30 dB	-3.5 dB		+3.5 dB
	40 dB	-3.5 dB		+3.5 dB
	50 dB	-3.5 dB		+3.5 dB
	60 dB	-3.5 dB		+3.5 dB
	70 dB	-3.5 dB		+3.5 dB

Table 1-30 Performance Test Record (11 of 11)

Para. No.	Test Description	Results		
		Min.	Actual	Max.
16	Input Attenuator Accuracy (cont'd)			
	<R3272 ONLY>			
	Step-to-Step Accuracy			
	20 dB	−1.8 dB		+1.8 dB
	30 dB	−1.8 dB		+1.8 dB
	40 dB	−1.8 dB		+1.8 dB
	50 dB	−1.8 dB		+1.8 dB
	60 dB	−1.8 dB		+1.8 dB
	70 dB	−1.8 dB		+1.8 dB
	<R3263/3463 ONLY>			
	(1.5 GHz Center Freq)			
	Switching Accuracy			
	20 dB	-2 dB		+2 dB
	30 dB	-2 dB		+2 dB
	40 dB	-2 dB		+2 dB
	50 dB	-2 dB		+2 dB
	60 dB	-2 dB		+2 dB
	70 dB	-2 dB		+2 dB
	Step-to-Step Accuracy			
	20 dB	−1.1 dB		+1.1 dB
	30 dB	−1.1 dB		+1.1 dB
	40 dB	−1.1 dB		+1.1 dB
	50 dB	−1.1 dB		+1.1 dB
	60 dB	−1.1 dB		+1.1 dB
	70 dB	−1.1 dB		+1.1 dB
17	Calibration Amplitude Accuracy	−10.3 dBm		−9.7 dBm

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LIMITED WARRANTY

1. Unless otherwise specifically agreed by Seller and Purchaser in writing, Advantest will warrant to the Purchaser that during the Warranty Period this Product (other than consumables included in the Product) will be free from defects in material and workmanship and shall conform to the specifications set forth in this Operation Manual.

2. The warranty period for the Product (the "Warranty Period") will be a period of one year commencing on the delivery date of the Product.

3. If the Product is found to be defective during the Warranty Period, Advantest will, at its option and in its sole and absolute discretion, either (a) repair the defective Product or part or component thereof or (b) replace the defective Product or part or component thereof, in either case at Advantest's sole cost and expense.

4. This limited warranty will not apply to defects or damage to the Product or any part or component thereof resulting from any of the following:

   (a) any modifications, maintenance or repairs other than modifications, maintenance or repairs (i) performed by Advantest or (ii) specifically recommended or authorized by Advantest and performed in accordance with Advantest 's instructions;

   (b) any improper or inadequate handling, carriage or storage of the Product by the Purchaser or any third party (other than Advantest or its agents);

   (c) use of the Product under operating conditions or environments different than those specified in the Operation Manual or recommended by Advantest, including, without limitation, (i) instances where the Product has been subjected to physical stress or electrical voltage exceeding the permissible range and (ii) instances where the corrosion of electrical circuits or other deterioration was accelerated by exposure to corrosive gases or dusty environments;

   (d) use of the Product in connection with software, interfaces, products or parts other than software, interfaces, products or parts supplied or recommended by Advantest;

   (e) incorporation in the Product of any parts or components (i) provided by Purchaser or (ii) provided by a third party at the request or direction of Purchaser or due to specifications or designs supplied by Purchaser (including, without limitation, any degradation in performance of such parts or components);

   (f) Advantest's incorporation or use of any specifications or designs supplied by Purchaser;

   (g) the occurrence of an event of force majeure, including, without limitation, fire, explosion, geological change, storm, flood, earthquake, tidal wave, lightning or act of war; or

   (h) any negligent act or omission of the Purchaser or any third party other than Advantest.

5. **EXCEPT TO THE EXTENT EXPRESSLY PROVIDED HEREIN, ADVANTEST HEREBY EXPRESSLY DISCLAIMS, AND THE PURCHASER HEREBY WAIVES, ALL WARRANTIES, WHETHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE, INCLUDING, WITHOUT LIMITATION, (A) ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE AND (B) ANY WARRANTY OR REPRESENTATION AS TO THE VALIDITY, SCOPE, EFFECTIVENESS OR USEFULNESS OF ANY TECHNOLOGY OR ANY INVENTION.**

6. **THE REMEDY SET FORTH HEREIN SHALL BE THE SOLE AND EXCLUSIVE REMEDY OF THE PURCHASER FOR BREACH OF WARRANTY WITH RESPECT TO THE PRODUCT.**

7. **ADVANTEST WILL NOT HAVE ANY LIABILITY TO THE PURCHASER FOR ANY INDIRECT, INCIDENTAL, SPECIAL, CONSEQUENTIAL OR PUNITIVE DAMAGES, INCLUDING, WITHOUT LIMITATION, LOSS OF ANTICIPATED PROFITS OR REVENUES, IN ANY AND ALL CIRCUMSTANCES, EVEN IF ADVANTEST HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES AND WHETHER ARISING OUT OF BREACH OF CONTRACT, WARRANTY, TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE. TORT (INCLUDING, WITHOUT LIMITATION, NEGLIGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

8. **OTHER THAN THE REMEDY FOR THE BREACH OF WARRANTY SET FORTH HEREIN, ADVANTEST SHALL NOT BE LIABLE FOR, AND HEREBY DISCLAIMS TO THE FULLEST EXTENT PERMITTED BY LAW ANY LIABILITY FOR, DAMAGES FOR PRODUCT FAILURE OR DEFECT, WHETHER ARISING OUT OF BREACH OF CONTRACT, TORT (INCLUDING, WITHOUT LIMITATION, NEGLEGENCE), STRICT LIABILITY, INDEMNITY, CONTRIBUTION OR OTHERWISE.**

CUSTOMER SERVICE DESCRIPTION

In order to maintain safe and trouble-free operation of the Product and to prevent the incurrence of unnecessary costs and expenses, Advantest recommends a regular preventive maintenance program under its maintenance agreement.

Advantest's maintenance agreement provides the Purchaser on-site and off-site maintenance, parts, maintenance machinery, regular inspections, and telephone support and will last a maximum of ten years from the date the delivery of the Product. For specific details of the services provided under the maintenance agreement, please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest 's sales representatives.

Some of the components and parts of this Product have a limited operating life (such as, electrical and mechanical parts, fan motors, unit power supply, etc.). Accordingly, these components and parts will have to be replaced on a periodic basis. If the operating life of a component or part has expired and such component or part has not been replaced, there is a possibility that the Product will not perform properly. Additionally, if the operating life of a component or part has expired and continued use of such component or part damages the Product, the Product may not be repairable. Please contact the nearest Advantest office listed at the end of this Operation Manual or Advantest's sales representatives to determine the operating life of a specific component or part, as the operating life may vary depending on various factors such as operating condition and usage environment.

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