ADVANTEST

ADVANTEST CORPORATION

U4941TG/NTG

RF FIELD ANALYZER

OPERATION MANUAL

MANUAL NUMBER OEA00 9506

Before reselling to other corporations or re-exporting to other countries, you are required to obtain permission from both the Japanese Government under its Export Control Act.

First printing June 15, 1995
Printed in Japan

PREFACE

(1) Applicable type to U4941TG/NTG
U4941TG (Input impedance of 50Ω system)
U4941NTG (Input impedance of 75Ω system)

(2) How to use Operation Manual
This document describes about tracking generator. For the explanation of functions other than tracking generator, see the separate volume "U4941 series Operation Manual" with replacing as follows.
U4941 series →U4941TG/NTG
U4941 →U4941TG
U4941N →U4941NTG

U4941TG/NTG Operation Manual	
Configuration	Contents
1. Outline	
2. Standard accessories	
3. Panels Front panel Rear panel	Use the separate volume "U4941 series Operation Manual" Chapter 3 together.
4. Operation method	
5. Function descriptions	Use the separate volume "U4941 series Operation Manual" Chapter 7 together.
6. GPIB command codes	Use the separate volume "U4941 series Operation Manual" Chapter 8 together.
7. Specifications	
8. Softkey menu	Use the separate volume "U4941 series Operation Manual"Section A.3 together.
A.1 Error message list	
External view (Front panel)	

No. ESA001

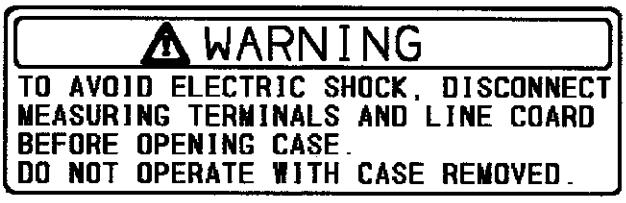
Safety Summary

To ensure thorough understanding of all functions and to ensure efficient use of this equipment, please read the Instruction 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 equipment.

Careful attention to personal safety should be paid when operating and servicing this equipment. Please be sure to always use this equipment correctly and safely.

■Warning Labels

Warning labels such as shown below 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.



■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. Do not place anything heavy on top of the power cable.

●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 equipment.

●Be sure to plug the power cable into an electrical outlet which has a safety ground terminal. Grounding will be defeated if you use an extension cord which does not include a safety ground terminal.

●Be sure to use fuses rated for the voltage in question.

●Do not use this equipment with the case open.

●Do not place any heavy objects on top of this equipment. Also, do not place flower pots or other containers containing liquid such as chemicals on top of or near this equipment.

●Do not stick or drop metal or easily flammable objects into the ventilation outlets of this equipment.

●In the case of products which emit laser light, do not look directly at the output connector edge or the connected fiber output edge.

■Caution Symbols Used Within the Instruction Manual

Symbols indicating items requiring caution which are used in this instruction 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 equipment or relating to a restriction on operation

■Safety Marks on the Product

The following safety marks can be found on Advantest products.

 : Indicates that care in handling is required. A reference to the appropriate pages in the instruction manual is given to protect yourself and the product.

 : Represents a ground symbol. This indicates field wiring terminals which must be grounded before using the equipment to prevent electric shock.

 : Indicates dangerous high voltage. This is placed at locations where 1000 volts or more is input or output.

 : Indicates a frame (or case) terminal. This is placed on terminals connected to the outside frame (or case) of the product.

 : Indicates alternating current (current or voltage).

 : Indicates direct current (current or voltage).

 : Indicates alternating current (current or voltage) and direct current (current or voltage).

■Precautions when Disposing of this Equipment

Be aware of the following harmful substances when disposing of this product and be sure they are disposed of properly. If you have questions on how to dispose of this product, please contact your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

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).

■Replacement Parts

Some parts used in this equipment are expected to wear out over time due to friction or other causes. Please replace these parts periodically to ensure a set level of performance. If you have questions about replacement parts, please ask your nearest Advantest dealer. Our address and phone number are listed at the end of this manual.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

1. OUTLINE

U4941TG/NTG is U4941 with a tracking generator. A tracking generator is a device that generates signals of the same frequency as the sweep frequency of a spectrum analyzer.

A tracking generator allows the measurement of filters or amplifiers.

This tracking generator outputs frequencies in the range of 100kHz to 2.2GHz.

The level of an output frequency varies from 0dBm to -31dBm in 1dB steps.

The output impedance of U4941TG is 50Ω.

The output impedance of U4941NTG is 75Ω.

MEMO 

2. STANDARD ACCESSORIES

If something is missing, please contact the dealer or the sales and support offices. Address and telephone numbers are listed at the end of this manual.

Table 2-1 Standard Accessories

Part Name	Specification		Quantity		Remarks
	Type Code	Stock No.	U4941TG	U4941NTG	
AC/DC Adapter	A08180	—	1	1	
AC Power supply cable	A01402	DCB-DD2428X01	1	1	
Power fuse	326010	DFT-AF10A	1	1	
N-BNC conversion adapter	JUG-201A/V	JCF-AF001EX03	1	—	U4941TG only
C15 type conversion adapter	NCP-NFJ	JCF-AF001EX06	—	1	U4941NTG only
NC-BNC conversion adapter	BA-A165	JCF-AF001EX04	—	1	
Carrying belt	—	—	1	1	
U4941 series Operation manual	—	JU4941 SERIES	1	1	Japanese version
	—	EU4941 SERIES			English version
U4941TG/NTG Operation manual	—	JU4941TG/NTG	1	1	Japanese version
	—	EU4941TG/NTG			English version
Quick guide	—	JU4941 SERIES(Q)	1	1	Japanese version
	—	EU4941 SERIES(Q)			English version

Note: When ordering additional accessories, please be sure to specify the Model (or Stock number).

MEMO

3. PANELS

This chapter briefly describes the analyzer's front, rear and top panels.

3.1 Front Panel

① to ㉙		:	Refer to the separate volume "U4941 series Operation Manual" 3.1 Front Panel ① to ㉙.
㉚	TG key	:	If it is pressed, LED lights up on it and TG starts.
㉛	N-Type connector	:	This is an output connector of a tracking generator.

3.2 Rear Panel

For the rear panel of U4941TG/NTG, refer to the separate volume "U4941 series Operation Manual" 3.2 Rear Panel .

3.3 Top Panel

For the top panel of U4941TG/NTG, refer to the separate volume "U4941 series Operation Manual" 3.3 Top Panel .

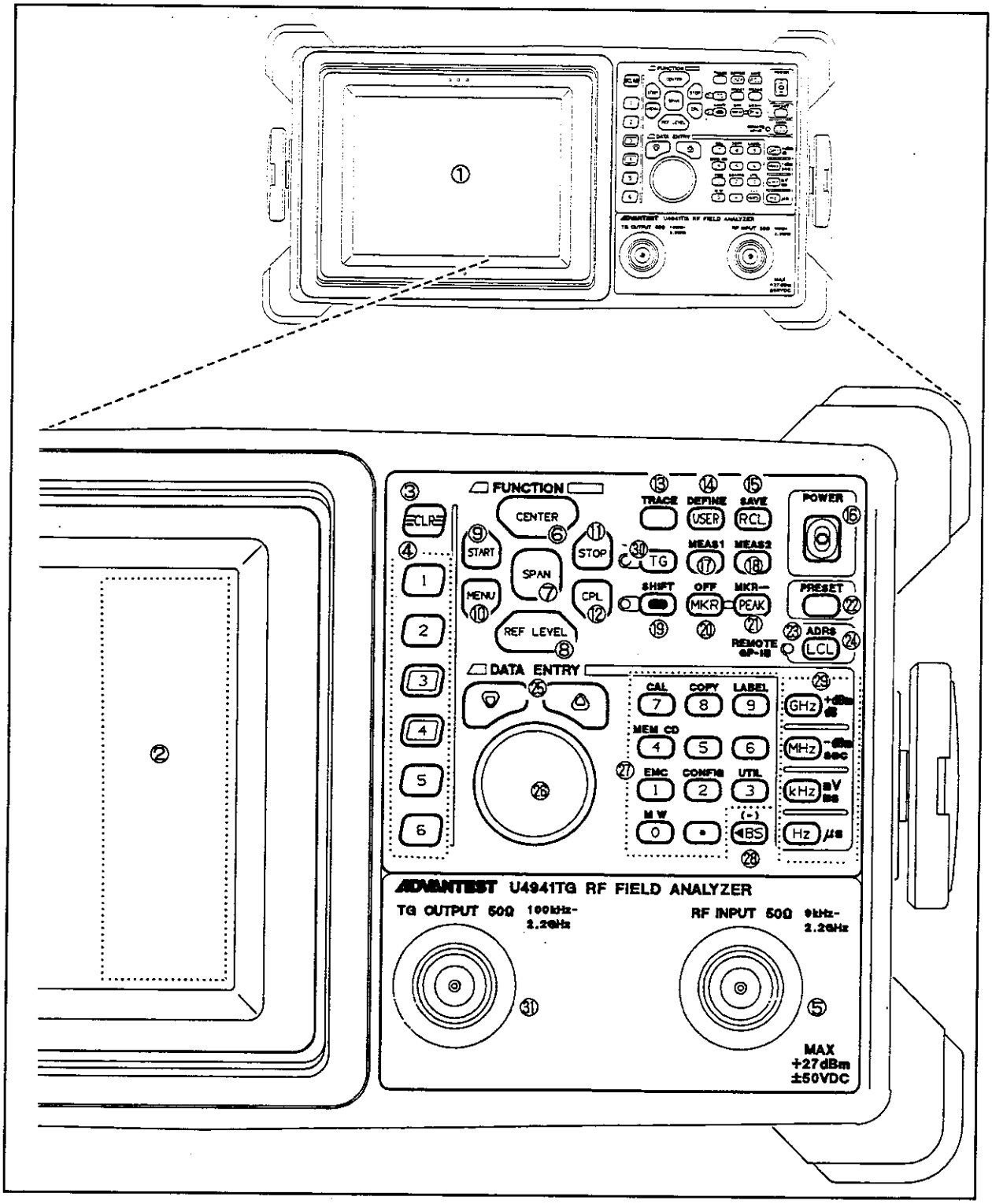


Figure 3-1 Front Panel (U4941TG)

4. OPERATION METHOD

4.1 Usage of Tracking Generator

[Operation method]

① Turn the tracking generator on to set its output level. (LED lights up upward on the left side of keys)

Then press (TG) [1 TG LEVEL] and set the output level with ten keys, step keys, or the data knob.
(It is possible to set the output level of 0dBm to -31dBm in 1dB steps.)

② Set a center frequency, a frequency span, and a reference level as follows.

Press (CENTER) and then adjust a center frequency with the ten keys, the step keys, or the data knob.

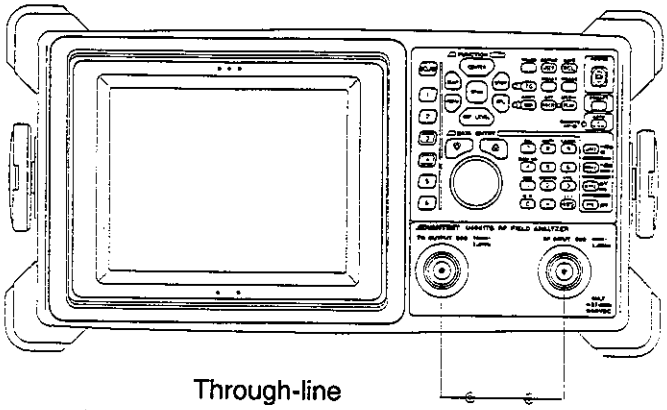
Press (SPAN) and then adjust a frequency span with the ten keys, the step keys, or the data knob.

Press (REF LEVEL) and then adjust a reference level with the ten keys, the step keys, or the data knob.

CAUTION

If resolution bandwidth is 120kHz or less, connect a cable between TG output connector and RF input connector and press [1 TG ADJ AUTO] to correct a tracking error (that is a level error caused by the difference between the output frequency of a tracking generator and the tuned frequency of a spectrum analyzer).

③ Connect a cable between TG OUTPUT connector and INPUT connector. A through-line frequency characteristic appears on the screen.



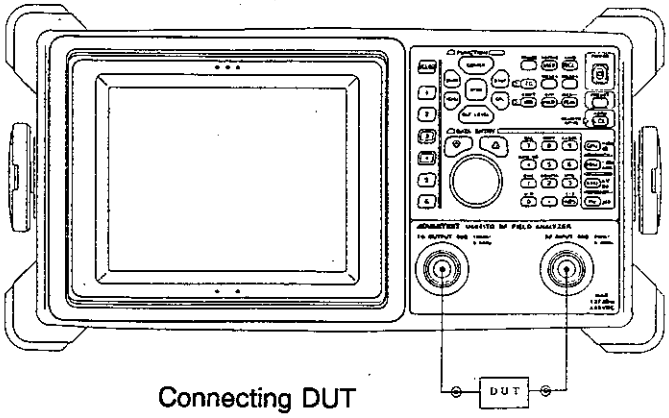
Through-line

④ If the transmission loss is not ignored, calibrate the loss according to Section 4.2.

⑤ Connect a device under test (DUT).

CAUTION

If the input and output impedance of DUT is not 50Ω (for U4941TG) or 75Ω (for U4941NTG), match the input and output impedance of DUT to that of TG INPUT and OUTPUT.



Connecting DUT

⑥ Opening of measurement
See Section 4.3.

4.2 How to Normalize a Frequency Characteristic with Reference to a Display Line

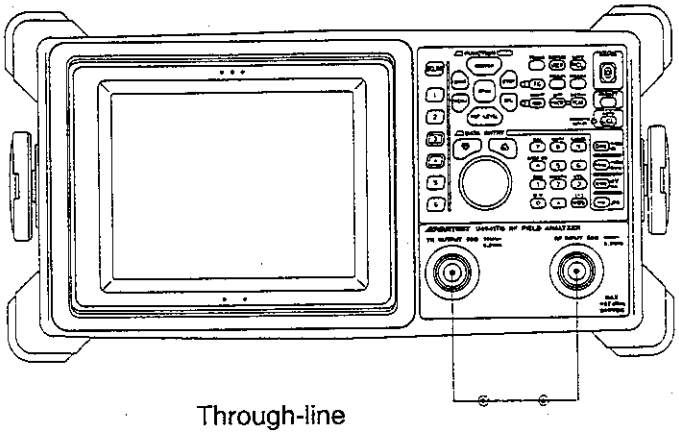
This section explain how to normalize the frequency characteristic of a cable with reference to a trace and a display line.
This operation normalizes the frequency characteristic of the spectrum analyzer itself and allows the correct measurement of the frequency characteristic of DUT such as a filter.

CAUTION

When changing the center frequency, frequency span, reference level and so on, are changed after having normalized the analyzer, the normalization has to be made again.

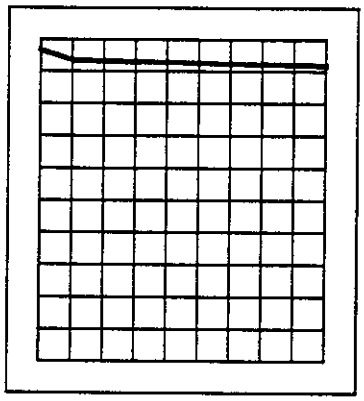
[Operation method]

① Connect a cable directly between the TG OUTPUT connector and the INPUT connector.



Through-line

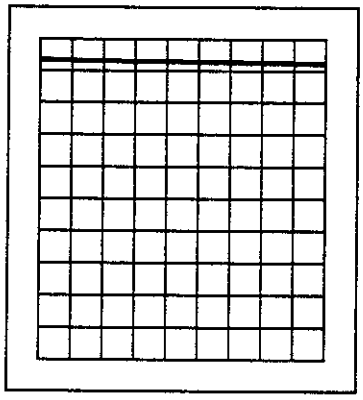
② Press REF LEVEL to adjust the reference level with the step keys or the data knob.



(Waveform image)

③ The frequency characteristic is normalized.

Press keys in order of TRACE, 6 TRACE MATH, 5 NORMALIZE, and 3 INSTANT NORMALIZE.



(Waveform image)

④ To release the normalization mode, press 1 NORMALIZE ON/OFF.

4.3 Measurement Example

The measurement of a filter and an amplifier is introduced as an example.

4.3.1 Measurement of a Filter's Damping Property

A band-pass filter with a passing band of around 900MHz is measured here.
Its characteristics are as follows.

Center frequency	: 200MHz
Passing bandwidth (3dB)	: Approx. 4.5MHz
Insertion loss	: Approx. 5dB
Input/output impedance	: 50Ω

(1) Normalizing the Measurement System

It is necessary to adjust the tracking generator (TG). See section 4.2.

① Connect a through line between the TG OUTPUT connector and the INPUT connector by using measuring cables.

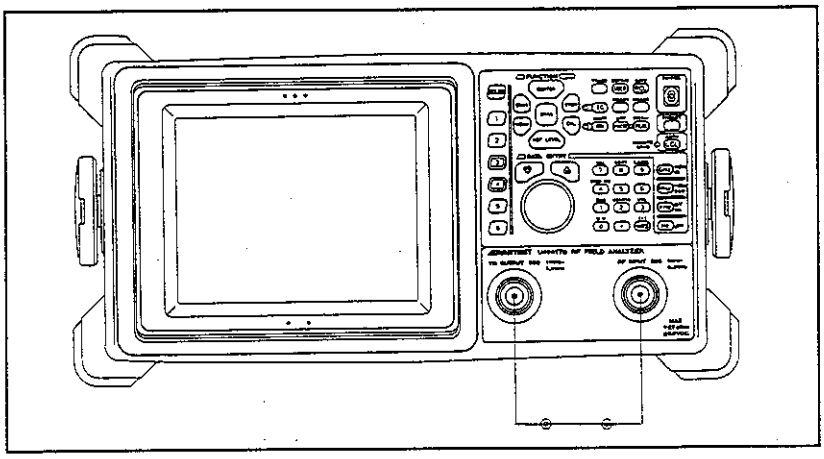


Figure 4-1 Through-line

② Press the PRESET key to preset the analyzer.

③ Press the TG key to turn on TG.

④ Press TG LEVEL 0 MHz (−dBm sec) to set the TG output level to 0dBm.

⑤ Press CENTER 2 0 0 MHz (−dBm sec) to set the center frequency to 200MHz.

⑥ Press [SPAN] [2] [0] [MHz] [-dBm/sec] to set the span to 20MHz.

⑦ Press [CPL] [1 RBW AUTO/MNL] [1] [0] [0] [kHz] [mV/ms] to set RBW to 100kHz.

⑧ Press [2 VBW AUTO/MNL] [1] [kHz] [mV/ms] to set VBW to 1kHz.

Note : The setting of RBW and VBW decreases the noise and make the waveform of the band-pass filter sharp.

⑨ Press [REF LEVEL] [1 dB/DIV] [2] [GHz] [+dBm/dB] to set the vertical axis to 2dB/div.

⑩ Press [REF LEVEL] and then move the waveform to the upper part of the screen by turning the data knob so that the waveform does not lie offscreen.

Press [CLR] to watch the full screen without the softkeys.

Then the screen changes as shown in Figure 4-2.

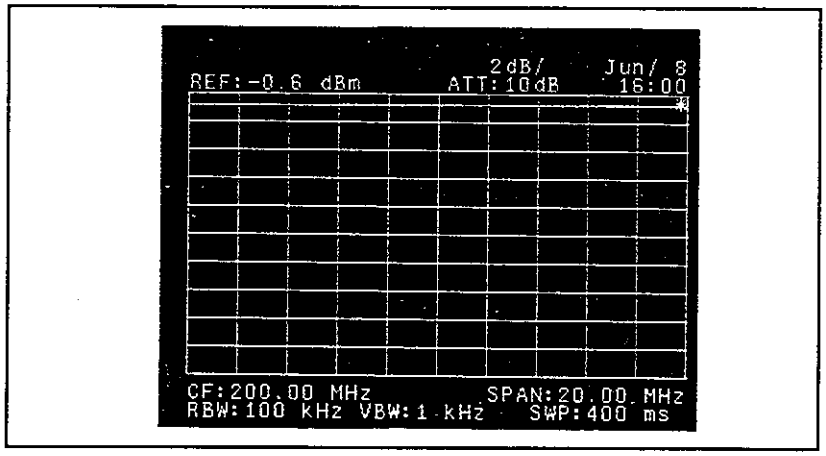


Figure 4-2 Clear Screen

Press [CLR] to recall the softkeys.

⑪ Press TRACE, 6 TRACE MATH, 5 NORMALIZE, 3 INSTANT NORMALIZE to normalize the system of measurement.
Then the screen changes as shown in Figure 4-3.

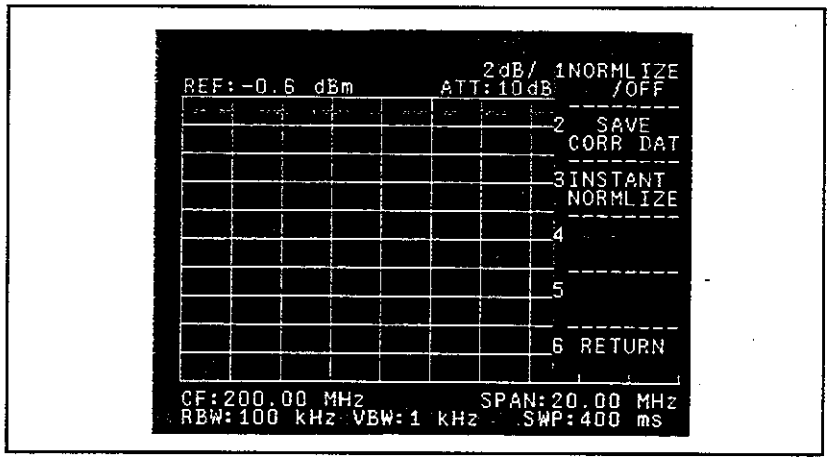


Figure 4-3 Normalize Screen

Now, the frequency characteristic became flat without DUT.

CAUTION

If functional values that have reference to normalization; for example, a center frequency, a frequency span, and a reference level, and so on, are changed under normalizing the analyzer, there is a possibility of not performing the normalization correctly. In such a case, normalize the analyzer again from the beginning.

(2) Starting Measurement

① Connect BPF between the TG OUTPUT connector and the INPUT connector by using measuring cables as shown in Figure 4-4.

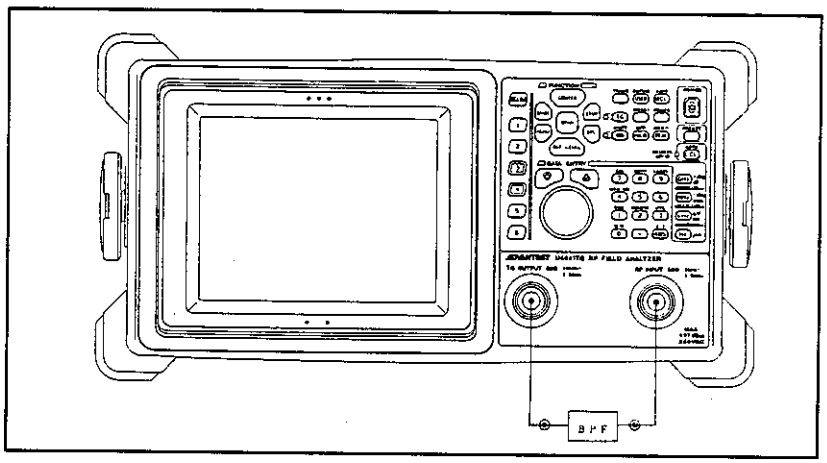


Figure 4-4 Connecting BPF

② Press CPL, 3 SWP AUTO/MNL, 2, MHz, –dBm sec to set the sweep time to 2 seconds.

Note : This setting allows the sweep time not to influence the waveform.

Then the screen changes as shown in Figure 4-5.

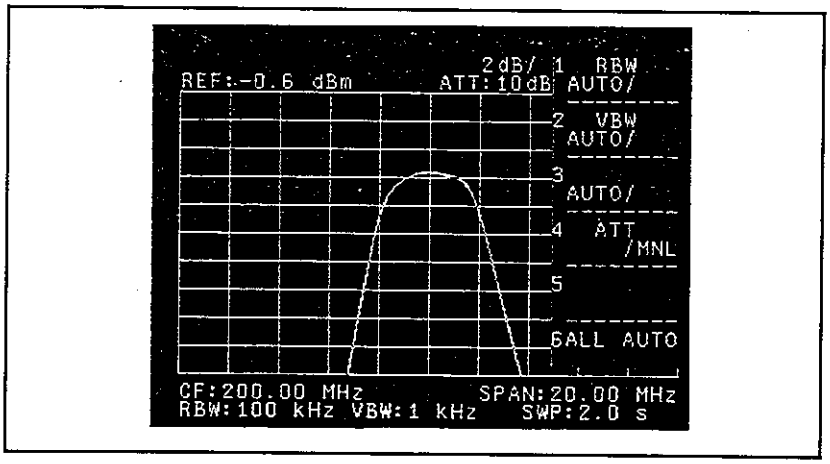


Figure 4-5 Sweep Time for 2 Seconds

Measuring the following three items.

(a) Insertion loss

(b) Passing bandwidth

(c) Attenuation

(a) Measurement of an insertion loss

① Press MKR 2 0 0 MHz (−dBm / sec) to locate a marker at 200MHz on the screen.

The insertion loss of 200MHz is displayed as the readout of the marker.

Note : When the display line is shown, a marker level indicates a value based on the display line.

Then the screen changes as shown in Figure 4-6.

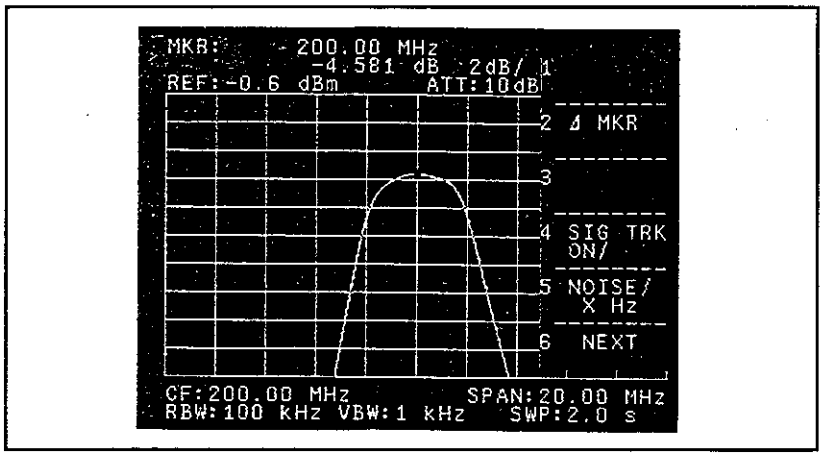


Figure 4-6 Measurement of an Insertion Loss

In this measurement, the insertion loss is 4.581dB.

(b) Measurement of a passing bandwidth (3dB)

① Press MEAS2 [1 dB DOWN] to set from the condition of measurement insertion loss to X dB DOWN mode.

② Press 3 GHz (+dBm / dB) to make an attention 3dB.

③ Press [1 XdB DOWN] to measure 3dB DOWN.

Then, two marker moves to points of 3dB below the level of 200MHz, respectively and then the markers indicate 3-dB passing bandwidth.

The screen becomes Figure 4-7.

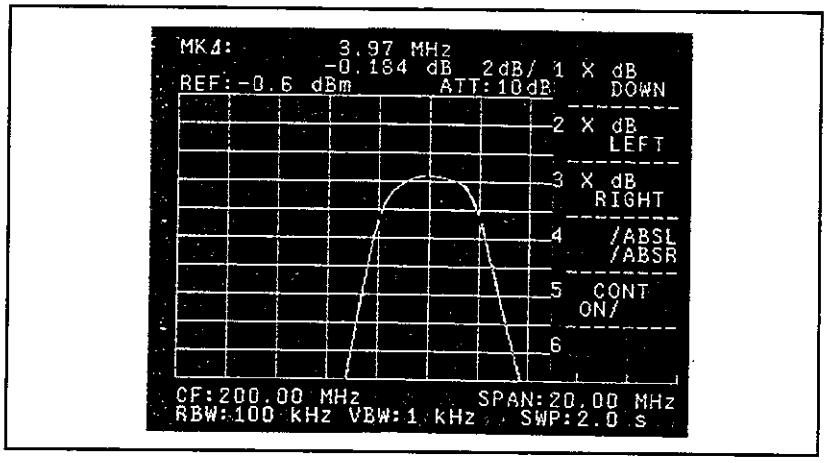


Figure 4-7 Measurement of a Passing Bandwidth

In this measurement, the 3-dB passing bandwidth is 3.97MHz.

(c) Measurement of an attenuation

Measurement of an attenuation at 14MHz, referred to the level of 200MHz.

① Press TRACE, 6 TRACE MATH, 5 NORMALIZE, 1 NORMALIZE ON/OFF to release normalization because the attenuation should be measured on a scale of 10dB/DIV not to be influenced by the through-line frequency characteristic.

② Press REF LEVEL, 1 dB/DIV, 1, 0, GHz (+dBm / dB) to set 10dB/DIV.

③ Press SPAN, 5, 0, MHz (−dBm / sec) to set the span to 50MHz.

④ Press MENU, 5 DSP LINE ON/OFF twice to turn the display line off.

⑤ Press MKR, 1 NORMAL MARKER, 2, 0, 0, MHz (−dBm / sec) to set a marker to 200MHz.

⑥ Press 2 ΔMKR to switch from the marker to ΔMKR, and then move the ΔMKR by 14MHz high monitoring the frequency of ΔMKR.

Press CLR to erase the soft menu.

Then the screen changes as shown in Figure 4-8.

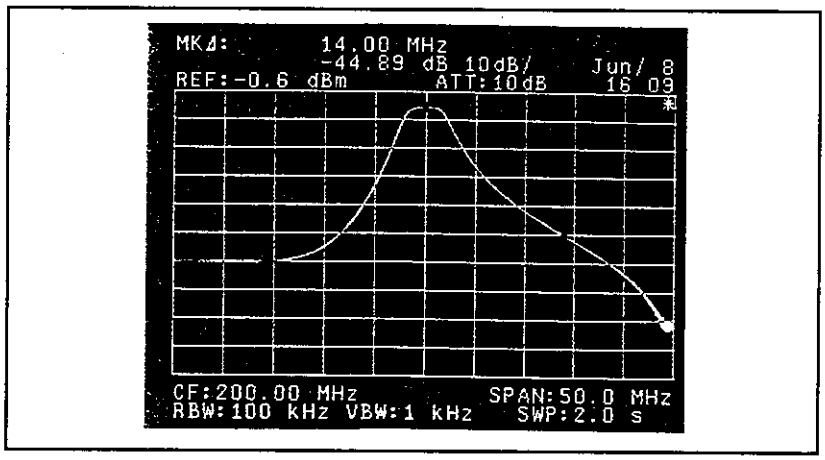


Figure 4-8 Measurement of an Attenuation

In this measurement, the attenuation is 44.89dB at the frequency of 14MHz.

4.4 Handling Precautions of Tracking Generator

(1) Dynamic Range

① The dynamic range of measurement is limited by the maximum output level of the TG part and the noise floor of the analyzer.
Making a resolution bandwidth RBW narrow expands the dynamic range.
If the local oscillation signal leaks from the TG part to the receiving part, there is possibilities that the noise level doesn't decrease at the maximum available resolution and that the dynamic range doesn't expand.

② If the loss of DUT (including its matching circuit) is big, the dynamic range also gets wrong. In such a case, the dynamic range can be improved by inserting an amplifier into the input or output port of DUT.

③ The location of an amplifier to be inserted is determined by conditions of DUT. Accordingly, it is necessary to study the characteristic of an amplifier to be inserted (for example, gain, flatness, noise figure, output level, 1-dB compression point, input/output VSWR, and so on).

④ If the tracking generator outputs an extreme large signal, decrease its output level.

(2) Time Response

① LCD displays a UNCAL message to indicate whether the level is correct or not. In the case of measuring the frequency characteristic with TG, however, ignore the UNCAL message.
This message indicates whether the IF filter responds sufficiently under conditions of [FREQ SPAN], [SWP], and [RBW] in the analyzer and whether a correct level is displayed.

② If the level change of a signal to be supplied from the output end of DUT to the spectrum analyzer is small, even if the UNCAL message is displayed, there are cases of displaying a correct level.

③ If the level of a signal to be supplied from the output end of DUT to the spectrum analyzer changes violently, the IF filter cannot respond.
Be careful to the time response of DUT.

④ If the characteristic displayed on the screen does not change even after switching SWP, the IF filter of the analyzer and DUT is responding sufficiently. If not, slow SWP down or make SPAN narrow, until the characteristic on the screen does not change.

(3) Overvoltage Protection of TG OUTPUT Connector

Don't apply a voltage of ±50V or more or a power of +13dBm or more to TG OUTPUT connector. (It will be broken with such a voltage or a power.)

(4) Output Level Overshooting at TG Turns on

When TG turns on, approx. 2dBm output level overshoot occurs for a short time.

CAUTION

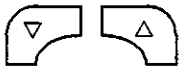
If DUT is weak in large level input, be careful to this output overshoot.

MEMO 

5. FUNCTION DESCRIPTIONS

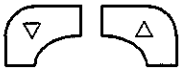
- TG (Function key)
  Pressing this key powers the tracking generator. LED lights up to show the tracking generator is on.

- TG LEVEL (Softkey)

  Pressing this key makes it possible to set the output level of the tracking generator with the ten keys plus the unit keys, the  keys, or the knob  .

- TG ADJ AUTO (Softkey)
  Press this key corrects a tracking error (an error to generate from the difference between the output frequency of the tracking generator and the tuning frequency of the spectrum analyzer part) automatically on condition that RBW is 120kHz or less.

- TG ADJ MANUAL (Softkey)

  Pressing this key makes it possible to correct a tracking error with the ten keys plus the unit keys, the  keys, or the knob  .

  LCD displays DA data of TG frequency adjustment.

- TG OFF (Softkey)
  Press this key powers the tracking generator off.

MEMO

6. GPIB COMMAND CODES

6.1 List of GPIB Command Codes

(Note) The following list describes GPIB codes for tracking generator. Refer to "8. LIST OF GPIB COMMAND CODES" in the separate volume "U4941 series Operation Manual".

Note on Table

- An asterisk (*) in the Listener Codes column indicates that you can send numeric data following that code by using a knob, numeric key or step key.
- AUTO/MANUAL or ON/OFF in the Output Formats column indicates that the code outputs 1 or 0, respectively.
- ON/OFF in the Output Formats column indicates that they output 1 or 0, respectively.
- All frequencies are in Hertz (Hz), and all times are in seconds or fractions of a second.
- Refer to an optionally available "GPIB Handbook" for information about the use of GPIB.

Function	Listener code	Talker request			Remarks
		Code	Output format	Header	
Tracking generator :ON :OFF	 TG TGF	 TG? —	 ON/OFF —	 — —	
Tracking generator output level	TGL*	TGL?	Level	Unit :Header dBm :TGB dBmV :TGM dBuV :TGU dBuVemf :TGE dBpW :TGP V :TGV W :TGW	
Tracking Generator ADJ :AUTO :MANUAL	 TGADJA TGADJM*	TGADJ? — —	AUTO/MANUAL — —	— — —	

MEMO 

7. SPECIFICATIONS

7.1 U4941TG Specifications

(1) Frequency

• Frequency range	9kHz to 2.2GHz
• Frequency readout accuracy (Start, Stop, CF, Marker frequency)	±(span × span accuracy + 0.15 × RBW + 50kHz)
• Count frequency marker Resolution Count accuracy	 1Hz to 1kHz ±(marker frequency × frequency reference accuracy + 1LSD + 5Hz) (S/N≥25dB, 50kHz≤SPAN≤10MHz, RBW≥100kHz)
• Frequency reference accuracy	$\pm 2 \times 10^{-6}$/Year $\pm 1 \times 10^{-5}$ (0°C to 50°C)
• Frequency span Range Accuracy	 50kHz to 2.4GHz, ZERO ≤ ±5% (SPAN≥100kHz)
• Frequency stability Residual FM Drift	 ≤3kHz p-p/100ms ≤10kHz (Frequency is fixed. 30 minutes after power ON. Sweep time: 50ms to 5s, temperature is fixed.)
• Sideband noise	≤ −100dBc/Hz (20kHz offset)
• Resolution bandwidth (3dB) Range Bandwidth range accuracy Selectivity Bandwidth (6dB)	 1kHz to 3MHz, 1-3 sequence ≤ ±20% (1kHz to 1MHz) ≤ ±25% (3MHz) ≤ 15 : 1 (60dB : 3dB) 9kHz, 120kHz
• Video bandwidth	10Hz to 3MHz

(2) Amplitude Range

• Measurement range	+20dBm to Average indicated noise level
• Maximum input level	
Preamplifier OFF	+27dBm (Input ATT ≥ 10dB)
	±50V DC max
Preamplifier ON	+13dBm
	±50V DC max
• Display range	
Log	10 × 10div
	10, 5, 2, 1dB/div
Linear	10% /div of reference level
QP Log	40dB (5dB/div)
• Reference level range	
Preamplifier OFF	
Log	−64dBm to +40dBm (0.1dB step)
Linear	141.1μV to 22.36V
Preamplifier ON	
Log	−84dBm to +5dBm (0.1dB step)
Linear	14.11μV to 707.1mV
• Input attenuator range	0 to 50dB (10dB step)

(3) Dynamic Range

• Display average noise level	
Preamplifier OFF	– 117dBm + 2.7f (GHz)dB (RBW 1kHz, VBW 10Hz, INPUT ATT 0dB, frequency 1MHz or more)
Preamplifier ON	– 132dBm + 3.3f (GHz)dB (RBW 1kHz, VBW 10Hz, INPUT ATT 0dB, frequency 1MHz or more)
• 1dB gain compression	
Preamplifier OFF	– 10dBm (mixer input level) Frequency 10MHz or more
Preamplifier ON	– 40dBm (RF input level) Frequency 10MHz or more
• Spurious response	
Preamplifier OFF	
2nd harmonic distortion	≤ – 70dB – 30dBm input (INPUT ATT 0 dB, frequency > 10MHz)
3rd-order inter modulation distortion	≤ – 70dB – 30dBm input (INPUT ATT 0dB, frequency > 10MHz)
• Residual response	
Preamplifier OFF	≤ – 100dBm (INPUT ATT 0dB, INPUT 50Ω terminated, frequency > 1MHz)
Preamplifier ON	≤ – 115dBm (INPUT ATT 0dB, INPUT 50Ω terminated, frequency > 1MHz)

(4) Amplitude Accuracy

• Frequency response Preamplifier OFF Preamplifier ON	 ≤ ±1.0dB (100kHz to 2GHz) ≤ ±2.0dB (9kHz to 2.2GHz) (INPUT ATT 10dB, 20°C to 30°C, referenced to 30MHz after automatic calibration) ≤ ±1.0dB (100kHz to 2GHz) ≤ ±2.0dB (9kHz to 2.2GHz) (INPUT ATT 0dB, 20°C to 30°C, referenced to 30MHz after self calibration)
• Calibration signal accuracy	−20dBm ±0.3dB
• IF gain error (after self calibration)	< ±0.5dB
• Scale fidelity accuracy (after self calibration) LOG LIN	 ≤ ±1.5dB/90dB ≤ ±1.0dB/10dB ≤ ±0.2dB/1dB ≤ ±5% of reference level
• Input attenuator (20 to 50dB settings referenced to 10dB)	≤ ±1.0dB (100kHz to 2GHz) ≤ ±1.5dB (9kHz to 2.2GHz)
• Resolution bandwidth switching error (after self calibration)	≤ ±1.0dB (at reference bandwidth: 3MHz)

(5) Sweep

• Sweep time Accuracy	50ms to 1000s and manual sweep ≤ ±5%
• Trigger mode	FREE RUN, SINGLE, VIDEO, EXT, TV

(6) Demodulation

• Spectrum demodulation	
Modulation type	AM, FM
Audio output	speaker and phone jack with volume control adjustable

(7) Input/Output

• RF input	
Connector	N-type female
Impedance	50Ω (nominal)
Preamplifier OFF	VSWR ≤ 1.5 (100kHz to 2GHz)
	VSWR ≤ 2.0 (9kHz to 2.2GHz)
	INPUT ATT ≥ 10dB
Preamplifier ON	VSWR ≤ 2.1 (10MHz to 2GHz)
	INPUT ATT ≥ 0dB
• 10MHz reference input	
Connector	BNC female, rear panel
Impedance	50Ω (nominal)
Input range	+8dBm to +16dBm
• Video output	
Connector	BNC female, rear panel
Impedance	75Ω (nominal), AC coupled
Amplitude (75Ω terminator)	Approx. 1Vp-p, 75Ω terminator (composite video signal)
• External trigger input	
Connector	BNC female, rear panel
Impedance	10kΩ (nominal), DC coupled
Trigger level	TTL level
• Gate input	
Connector	BNC female, rear panel
Impedance	10kΩ (nominal)
Sweep stop	during TTL level low level
Sweep continue	during TTL level high level
• Phone output	
Connector	Subminiature monophonic jack, front panel
Power output	0.2 watt max. 8Ω (nominal)

(cont'd)

• GPIB Plotter Printer	IEEE-488, bus connector Supports R9833, HP7470A, HP7475A, HP7440A, HP7550A, HP2225AJ
• RS-232	D-SUB 9 pin, rear panel
• Power input Battery mounter adapted	 Advantest AC/DC adapter Model: A08180 Automatically selections between 100VAC and 200VAC Antonbauer Inc: Magnum 14 battery (nominal 70WH)

(8) Tracking Generator

• Frequency range	100kHz to 2.2GHz
• Output level	0 to -31dBm (in 1dB steps)
• Accuracy output level	±0.5dB at 30MHz, at -10dBm (20°C to 30°C)
• Frequency characteristic	±0.7dB up to 1GHz ±1.5dB 100kHz to 2.2GHz
• Attenuation accuracy	±1dB 100kHz to 1GHz ±2dB 100kHz to 2.2GHz
• Harmonics	-20dBc or less
• Non harmonics	-30dBc or less
• TG leakage	-95dBm or less
• Output impedance	50Ω VSWR 1.5 or less from 100kHz to 2GHz 2.0 or less from 100kHz to 2.2GHz

(9) General Specifications

• Environment temperature	
Operating temperature	0°C to +50°C
Non-operating temperature	−20°C to +60°C
Relative humidity	RH 85% or less
• Power supply	
External DC input	Connector: XLR 4 pin
	Input range: +10V to +16V
Power consumption during DC operation	50W max.
During AC adapter is used	Automatically selections between 100VAC and 220VAC
During 100 VAC operation	Voltage: 90V to 132V
	Power consumption: 110VA max
	Frequency: 48Hz to 66Hz
During 220 VAC operation	Voltage: 198V to 250V
	Power consumption: 110VA max.
	Frequency: 48Hz to 66Hz
• Mass	Approx. 7kg
	(Without option, accessory, carrying belt and battery)
• Dimensions	Approx. 148mm (height) × 291mm (wide) × 330mm (depth)
	Excluding the projecting (legs, connector, etc.).
• External memory	
Memory card	2 slot, upper panel
	Connector: JEIDA-Ver4.1, PCMCIA Rel 2.0

7.2 U4941NTG Specifications

(1) Frequency

• Frequency range	9kHz to 2.2GHz
• Frequency readout accuracy (Start, Stop, CF, Marker frequency)	±(span × apan accuracy + 0.15 × RBW + 50kHz)
• Count frequency marker Resolution Count accuracy	 1Hz to 1kHz ±(marker frequency × frequency reference accuracy + 1LSD + 5Hz) (S/N≥25dB, 50kHz≤SPAN≤10MHz, RBW≥100kHz)
• Frequency reference accuracy	$\pm 2 \times 10^{-6}$/Year $\pm 1 \times 10^{-5}$ (0°C to 50°C)
• Frequency span Range Accuracy	 50kHz to 2.4GHz, ZERO ≤ ±5% (SPAN≥100kHz)
• Frequency stability Residual FM Drift	 ≤3kHz p-p/100ms ≤10kHz (Frequency is fixed. 30 minutes after power ON. Sweep time: 50ms to 5s, temperature is fixed.)
• Sideband noise	≤ −100dBc/Hz (20kHz offset)
• Resolution bandwidth (3dB) Range Bandwidth range accuracy Selectivity Bandwidth (6dB)	 1kHz to 3MHz, 1-3 sequence ≤ ±20% (1kHz to 1MHz) ≤ ±25% (3MHz) ≤ 15 : 1 (60dB : 3dB) 9kHz, 120kHz
• Video bandwidth	10Hz to 3MHz

(2) Amplitude Range

• Measurement range	+130dBμV to Average indicated noise level
• Maximum input level Preamplifier OFF Preamplifier ON	 +134dBμV (Input ATT ≥ 10dB) ±50V DC max +120dBμV ±50V DC max
• Display range Log Linear QP Log	 10 × 10div 10, 5, 2, 1 dB/div 10% div of reference level 40dB (5dB/div)
• Reference level range Preamplifier OFF Log Linear Preamplifier ON Log Linear	 +46dBμV to +150dBμV (0.1dB step) 199.5μV to 31.62V +26dBμV to +115dBμV (0.1dB step) 19.95μV to 1V
• Input attenuator range	0 to 50dB (10dB step)

(3) Dynamic Range

• Display average noise level	
Preamplifier OFF	– 8dBμV + 2.7f (GHz)dB (RBW 1kHz, VBW 10Hz, INPUT ATT 0dB, frequency 1MHz or more)
Preamplifier ON	– 23dBμV + 3.3f (GHz)dB (RBW 1kHz, VBW 10Hz, INPUT ATT 0dB, frequency 1MHz or more)
• 1dB gain compression	
Preamplifier OFF	> + 100dBμV (mixer input level) Frequency 10MHz or more
Preamplifier ON	> + 70dBμV (RF input level) Frequency 10MHz or more
• Spurious response	
Preamplifier OFF	
2nd harmonic distortion	≤ – 70dB + 78dBμV input (INPUT ATT 0dB, frequency > 10MHz)
3rd-order inter modulation distortion	≤ – 70dB + 78dBμV input (INPUT ATT 0dB, frequency > 10MHz)
• Residual response	
Preamplifier OFF	≤ + 10dBμV (INPUT ATT 0dB, INPUT 75Ω terminated, frequency > 1MHz)
Preamplifier ON	≤ – 5dBμV (INPUT ATT 0dB, INPUT 75Ω terminated, frequency > 1MHz)

(4) Amplitude Accuracy

• Frequency response Preamplifier OFF Preamplifier ON	 ≤ ±1.0dB (100kHz to 2GHz) ≤ ±2.0dB (9kHz to 2.2GHz) (INPUT ATT 10dB, 20°C to 30°C, referenced to 30MHz after automatic calibration) ≤ ±1.0dB (100kHz to 2GHz) ≤ ±2.0dB (9kHz to 2.2GHz) (INPUT ATT 0dB, 20°C to 30°C, referenced to 30MHz after self calibration)
• Calibration signal accuracy	+90.5dBμV ± 0.3dB
• IF gain error (after self calibration)	< ±0.5dB
• Scale fidelity accuracy (after self calibration) LOG LIN	 ≤ ±1.5dB/90dB ≤ ±1.0dB/10dB ≤ ±0.2dB/1dB ≤ ±5% of reference level
• Input attenuator (20 to 50dB settings referenced to 10dB)	≤ ±1.0dB (100kHz to 2GHz) ≤ ±1.5dB (9kHz to 2.2GHz)
• Resolution bandwidth switching error (after self calibration)	≤ ±1.0dB (at reference bandwidth: 3MHz)

(5) Sweep

• Sweep time Accuracy	50ms to 1000s and manual sweep ≤ ±5%
• Trigger mode	FREE RUN, SINGLE, VIDEO, EXT, TV

(6) Demodulation

• Spectrum demodulation	
Modulation type	AM, FM
Audio output	speaker and phone jack with volume control adjustable

(7) Input/Output

• RF input	
Connector	N-type female
Impedance	75Ω (nominal)
Preamplifier OFF	VSWR≤1.5 (100kHz to 2GHz)
	VSWR≤2.0 (9kHz to 2.2GHz)
	INPUT ATT≥10dB
Preamplifier ON	VSWR≤2.1 (10MHz to 2GHz)
	INPUT ATT≥0dB
• 10MHz reference input	
Connector	BNC female, rear panel
Impedance	50Ω (nominal)
Input range	+8dBm to +16dBm
• Video output	
Connector	BNC female, rear panel
Impedance	75Ω (nominal), AC coupled
Amplitude (75Ω terminator)	Approx. 1Vp-p, 75Ω terminator (composite video signal)
• External trigger input	
Connector	BNC female, rear panel
Impedance	10kΩ (nominal), DC coupled
Trigger level	TTL level
• Gate input	
Connector	BNC female, rear panel
Impedance	10kΩ (nominal)
Sweep stop	during TTL level low level
Sweep continue	during TTL level high level
• Phone output	
Connector	Subminiature monophonic jack, front panel
Power output	0.2 watt, 8Ω (nominal)

(cont'd)

• GPIB Plotter Printer	IEEE-488, bus connector Supports R9833, HP7470A, HP7475A, HP7440A, HP7550A, HP2225AJ
• RS-232	D-SUB 9 pin, rear panel
• Power input Battery mounter adapted	 Advantest AC/DC adapter Model: A08180 Automatically selections between 100VAC and 200VAC Antonbauer Inc: Magnum 14 battery (nominal 70WH)

(8) Tracking Generator

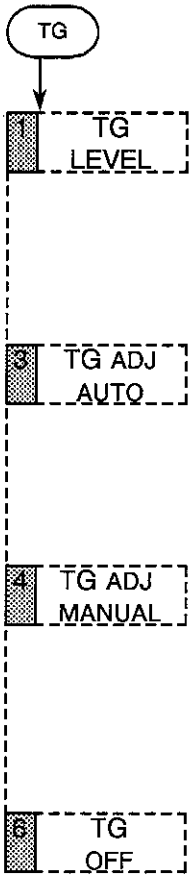
• Frequency range	100kHz to 2.2GHz
• Output level	105dBμ to 74dBμ
• Accuracy output level	±0.5dB at 30MHz, at 95dBμ (20°C to 30°C)
• Frequency characteristic	Based on 30MHz, 95dBμ
• Attenuation accuracy	±1dB 100kHz to 1GHz ±2dB 100kHz to 2.2GHz
• Harmonics	-20dBc or less
• Non harmonics	-30dBc or less
• TG leakage	16dBμ or less
• Output impedance	75Ω VSWR 1.5 or less from 100kHz to 2GHz 2.0 or less from 100kHz to 2.2GHz

(9) General Specifications

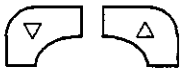
• Environment temperature	
Operating temperature	0°C to +50°C
Non-operating temperature	−20°C to +60°C
Relative humidity	RH 85% or less
• Power supply	
External DC input	Connector: XLR 4 pin Input range: +10V to +16V
Power consumption during DC operation	50W max.
During AC adapter is used	Automatically selections between 100VAC and 200VAC
During 100 VAC operation	Voltage: 90V to 132V Power consumption: 110VA max Frequency: 48Hz to 66Hz
During 220 VAC operation	Voltage: 198V to 250V Power consumption: 110VA max. Frequency: 48Hz to 66Hz
• Mass	Approx. 7kg (Without option, accessory, carrying belt and battery)
• Dimensions	Approx. 148mm (height) × 291mm (wide) × 330mm (depth) Excluding the projecting (legs, connector, etc.).
• External memory	
Memory card	2 slot, upper panel Connector: JEIDA-Ver4.1, PCMCIA Rel 2.0

8. SOFTKEY MENU

(Note) For the softkey menus except for the followings, refer to the separate volume "U4941 series Operation manual" A.3 Menu Lists.



··· Pressing this key powers the tracking generator. LED lights up to show the tracking generator is on.

··· Pressing this key makes it possible to set the output level of the tracking generator with the ten keys plus the unit keys, the  keys, or the knob  .

··· Press this key corrects a tracking error (an error to generate from the difference between the output frequency of the tracking generator and the tuning frequency of the spectrum analyzer part) automatically on condition that RBW is 120kHz or less.

··· Pressing this key makes it possible to correct a tracking error with the ten keys plus the unit keys, the  keys, or the knob  .

LCD displays DA data of TG frequency adjustment.

··· Press this key powers the tracking generator off.

MEMO

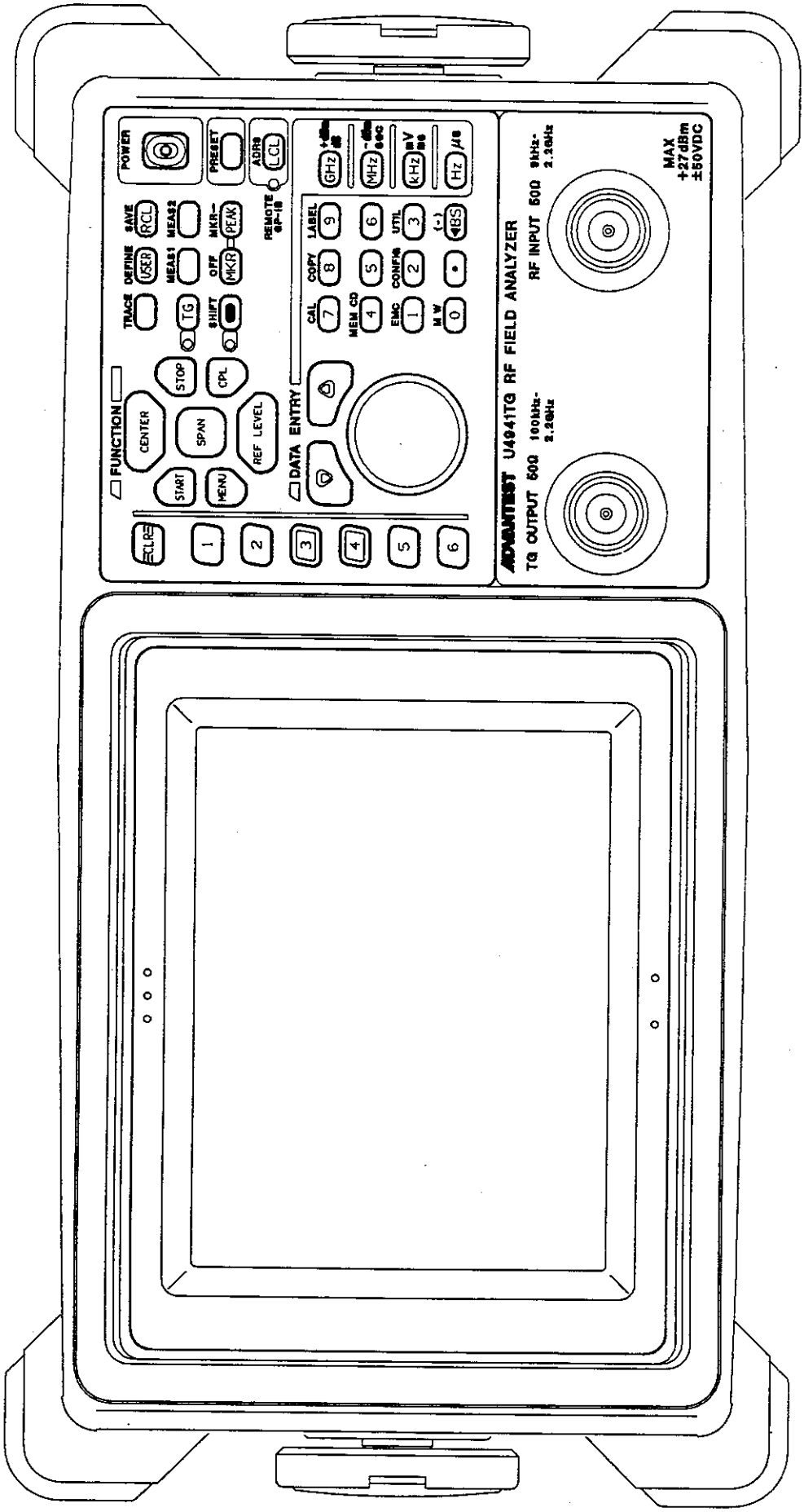
APPENDIX

A.1 Error Message List

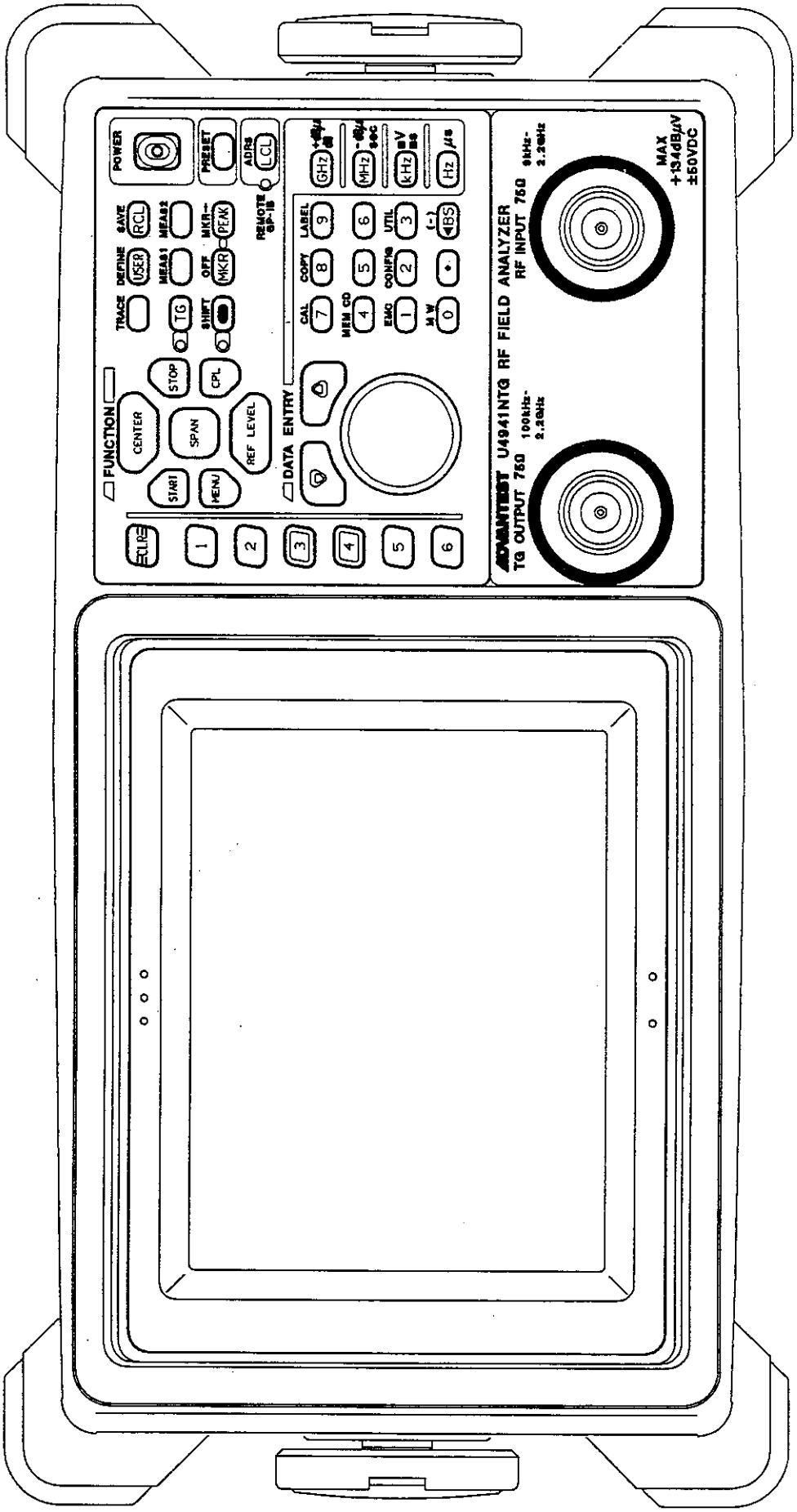
Error code	Message	Description
ERR 120:	TG OUTPUT?	The automatic adjustment of TG ADJ cannot be executed because TG output signal is not detected.
ERR 121:	?? TG ADJ	An error occurs in the automatic adjustment of TG ADJ.

MEMO

ALPHABETICAL INDEX



U4941TG
FRONT VIEW



U4941NTG
FRONT VIEW

IMPORTANT INFORMATION FOR ADVANTEST SOFTWARE

PLEASE READ CAREFULLY: This is an important notice for the software defined herein. Computer programs including any additions, modifications and updates thereof, operation manuals, and related materials provided by Advantest (hereafter referred to as "SOFTWARE"), included in or used with hardware produced by Advantest (hereafter referred to as "PRODUCTS").

SOFTWARE License

All rights in and to the SOFTWARE (including, but not limited to, copyright) shall be and remain vested in Advantest. Advantest hereby grants you a license to use the SOFTWARE only on or with Advantest PRODUCTS.

Restrictions

(1) You may not use the SOFTWARE for any purpose other than for the use of the PRODUCTS.
(2) You may not copy, modify, or change, all or any part of, the SOFTWARE without permission from Advantest.
(3) You may not reverse engineer, de-compile, or disassemble, all or any part of, the SOFTWARE.

Liability

Advantest shall have no liability (1) for any PRODUCT failures, which may arise out of any misuse (misuse is deemed to be use of the SOFTWARE for purposes other than it's intended use) of the SOFTWARE. (2) For any dispute between you and any third party for any reason whatsoever including, but not limited to, infringement of intellectual property rights.

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.

SALES & SUPPORT OFFICES

Advantest Korea Co., Ltd.
22BF, Kyobo KangNam Tower,
1303-22, Seocho-Dong, Seocho-Ku, Seoul #137-070, Korea
Phone: +82-2-532-7071
Fax: +82-2-532-7132

Advantest (Suzhou) Co., Ltd.
Shanghai Branch Office:
Bldg. 6D, NO.1188 Gumei Road, Shanghai, China 201102 P.R.C.
Phone: +86-21-6485-2725
Fax: +86-21-6485-2726

Shanghai Branch Office:
406/F, Ying Building, Quantum Plaza, No. 23 Zhi Chun Road,
Hai Dian District, Beijing,
China 100083
Phone: +86-10-8235-3377
Fax: +86-10-8235-6717

Advantest (Singapore) Pte. Ltd.
438A Alexandra Road, #08-03/06
Alexandra Technopark Singapore 119967
Phone: +65-6274-3100
Fax: +65-6274-4055

Advantest America, Inc.
3201 Scott Boulevard, Suite, Santa Clara, CA 95054, U.S.A
Phone: +1-408-988-7700
Fax: +1-408-987-0691

ROHDE & SCHWARZ Europe GmbH
Mühldorfstraße 15 D-81671 München, Germany
(P.O.B. 80 14 60 D-81614 München, Germany)
Phone: +49-89-4129-13711
Fax: +49-89-4129-13723

ADVANTEST®

http://www.advantest.co.jp

ADVANTEST CORPORATION
Shin-Marunouchi Center Building, 1-6-2 Marunouchi, Chiyoda-ku, Tokyo 100-0005, Japan
Phone: +81-3-3214-7500