

**MN1602A**  
**Programmable Preselector**  
**Operation Manual**

**Fourth Edition**

**Read this manual before using the equipment.**  
**Keep this manual with the equipment.**

**Measuring Instruments Division**  
**Measurement Group**

**ANRITSU CORPORATION**

NOV.  
1998

## Safety Symbols

To prevent the risk of personal injury or loss related to equipment malfunction, Anritsu Corporation uses the following safety symbols to indicate safety-related information. Insure that you clearly understand the meanings of the symbols **BEFORE** using the equipment.

### Symbols used in manual

- DANGER** This indicates a very dangerous procedure that could result in serious injury or death if not performed properly.
- WARNING** This indicates a hazardous procedure that could result in serious injury or death if not performed properly.
- CAUTION** This indicates a hazardous procedure or danger that could result in light-to-severe injury, or loss related to equipment malfunction, if proper precautions are not taken.

### Safety Symbols Used on Equipment and in Manual

(Some or all of the following five symbols may not be used on all Anritsu equipment. In addition, there may be other labels attached to products which are not shown in the diagrams in this manual.) The following safety symbols are used inside or on the equipment near operation locations to provide information about safety items and operation precautions. Insure that you clearly understand the meanings of the symbols and take the necessary precautions **BEFORE** using the equipment.



This indicates a prohibited operation. The prohibited operation is indicated symbolically in or near the barred circle.



This indicates an obligatory safety precaution. The obligatory operation is indicated symbolically in or near the circle.



This indicates warning or caution. The contents are indicated symbolically in or near the triangle.



This indicates a note. The contents are described in the box.



These indicate that the marked part should be recycled.

MN1602A Programmable Preselector  
Operation Manual

October 1988 (First Edition)  
June 1996 (Fourth Edition)

Copyright © 1988 – 1996 by Anritsu Corporation

All rights reserved. No part of this manual may be reproduced without the prior written permission of Anritsu Corporation.

The contents of this manual may be changed without prior notice.

Printed in Japan

## For Safety

### WARNING



Repair

WARNING 

Falling Over

1. Always refer to the operation manual when working near locations at which the alert mark shown on the left is attached. If the operation, etc., is performed without heeding the advice in the operation manual, there is a risk of personal injury. In addition, the equipment performance may be reduced.  
Moreover, this alert mark is sometimes used with other marks and descriptions indicating other dangers.
2. When supplying power to this equipment, connect the accessory 3-pin power cord to a 3-pin grounded power outlet. If a grounded 3-pin outlet is not available, before supplying power to the equipment, use a conversion adapter and ground the green wire, or connect the frame ground on the rear panel of the equipment to ground. If power is supplied without grounding the equipment, there is a risk of receiving a severe or fatal electric shock.
3. This equipment cannot be repaired by the user. DO NOT attempt to open the cabinet or to disassemble internal parts. Only Anritsu-trained service personnel or staff from your sales representative with a knowledge of electrical fire and shock hazards should service this equipment. There are high-voltage parts in this equipment presenting a risk of severe injury or fatal electric shock to untrained personnel. In addition, there is a risk of damage to precision parts.
4. This equipment should be used in the correct position. If the cabinet is turned on its side, etc., it will be unstable and may be damaged if it falls over as a result of receiving a slight mechanical shock.

## — For Safety —

### CAUTION

#### Changing Fuse

### CAUTION

1. Before changing the fuses, ALWAYS remove the power cord from the poweroutlet and replace the blown fuses. Always use new fuses of the type and rating specified on the fuse marking on the rear panel of the cabinet.

T □ □ □ A indicates a time-lag fuse.

□ □ □ A or F □ □ □ A indicate a normal fusing type fuse.

There is risk of receiving a fatal electric shock if the fuses are replaced with the power cord connected.

2. Keep the power supply and cooling fan free of dust.
  - Clean the power inlet regularly. If dust accumulates around the power pins, there is a risk of fire.
  - Keep the cooling fan clean so that the ventilation holes are not obstructed. If the ventilation is obstructed, the cabinet may overheat and catch fire.

#### Cleaning

# Equipment Certificate

Anritsu Corporation certifies that this equipment was tested before shipment using calibrated measuring instruments with direct traceability to public testing organizations recognized by national research laboratories including the Electrotechnical Laboratory, the National Research Laboratory and the Communication Research laboratory, and was found to meet the published specifications.

## Anritsu Warranty

Anritsu Corporation will repair this equipment free-of-charge if a malfunction occurs within 1 year after shipment due to a manufacturing fault, provided that this warranty is rendered void under any or all of the following conditions.

- The fault is outside the scope of the warranty conditions described in the operation manual.
- The fault is due to misoperation, misuse, or unauthorized modification or repair of the equipment by the customer.
- The fault is due to severe usage clearly exceeding normal usage.
- The fault is due to improper or insufficient maintenance by the customer.
- The fault is due to natural disaster including fire, flooding and earthquake, etc.
- The fault is due to use of non-specified peripheral equipment, peripheral parts, consumables, etc.
- The fault is due to use of a non-specified power supply or in a non-specified installation location.

In addition, this warranty is valid only for the original equipment purchaser. It is not transferable if the equipment is resold.

Anritsu Corporation will not accept liability for equipment faults due to unforeseen and unusual circumstances, nor for faults due to mishandling by the customer.

## Anritsu Corporation Contact

If this equipment develops a fault, contact the head office of Anritsu Corporation at the address in the operation manual, or your nearest sales or service office listed on the following pages.

Note 1:

1. The instrument is operable on a nominal voltage of 100 to 127 Vac or 200 to 250 Vac by changing the connections on the power transformer taps.

The voltage and current ratings are indicated on the rear panel when the instrument is shipped from the factory.






To operate on the other voltage, change the connections on the power supply transformer. The plate on the rear panel indicating the voltage and current ratings should be changed to the appropriate one. Order the plate from ANRITSU CORP. if needed.

2. In this manual, the power supply voltage and current ratings are represented by \*\*Vac and \*\*\*A, respectively.
3. The relationship between power supply voltage and current rating is shown below.

**Vac	***A
100 to 127 V	1.6 A, F0010
200 to 250 V	0.8 A, F0007

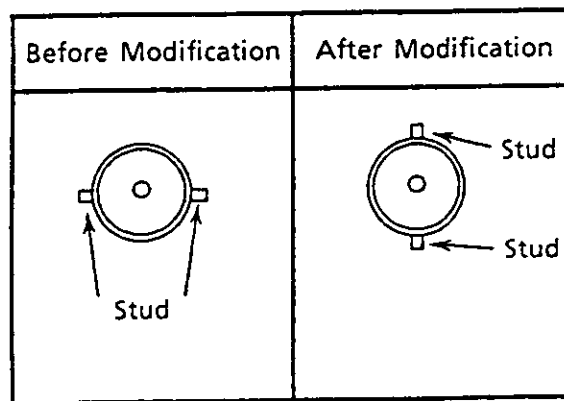
## OPERATION KEY REPRESENTATIONS

The operation keys in the descriptions of the operating procedure are represented as shown below.

Representation example		Meaning
<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>LOCAL</p>  </div> <div style="text-align: center;"> <p>SHIFT</p>  </div> <div style="text-align: center;"> <p>GP-IB</p>  </div> </div>		<p>When only a key is shown in the operating procedure, it means press the key. Actions performed one or more times, such as [press several times], [press continuously], etc. are appended.</p>
<p>[LOCAL] [SHIFT] [GP-IB]</p>		<p>As a rule, key representations in the text are enclosed in [ ].</p>
<p>Key lamp</p>	<p>On</p> <div style="text-align: center;"> <p>SHIFT</p>  </div>	<p>Lighting of a key lamp is represented by ■.</p>
	<p>Off</p> <div style="text-align: center;"> <p>SHIFT</p>  </div>	<p>Turning off a key lamp is represented by □.</p>

## BNC-TYPE CONNECTOR INSTALLATION

The BNC-type connector installation has been modified as follows:





# CE Marking

Anritsu affix the CE Conformity Marking on the following product (s) accordance with the Council Directive 93/68/EEC to indicate that they conform with the EMC directive of the European Union (EU).

## CE Conformity Marking



### 1. Product Name/Model Name

Product Name: Programmable Preselector

Model Name: MN1602A

### 2. Applied Directive

EMC: Council Directive 89/336/EEC

### 3. Applied Standards

Electromagnetic radiation:

EN55011 (ISM, Group 1, Class A equipment)

Immunity:

EN50082-1

IEC801-2 (ESD) 4 kVCD, 8 kVAD

IEC801-3 (Rad.) 3 V/m

IEC801-4 (EFT) 1 kV

Performance Criteria\*

B

A

B

\*: Performance Criteria

A: No performance degradation or function loss

B: Self-recovered temporary degradation of performance or temporary loss of function

( Blank )

## TABLE OF CONTENTS

	Page
For Safety .....	iii
SECTION 1 GENERAL .....	1-1
SECTION 2 COMPOSITION AND SPECIFICATIONS	
2.1 Standard Composition .....	2-1
2.2 Specifications .....	2-2
SECTION 3 OPERATION	
3.1 Precautions .....	3-1
3.1.1 Power supply .....	3-1
3.1.2 Environmental conditions .....	3-1
3.1.3 Maximum applied voltage level .....	3-2
3.2 Front and Rear Panels .....	3-3
3.3 Measurement Preparation .....	3-11
3.3.1 Power setup .....	3-11
3.3.2 MN1602A and MS2601A setup .....	3-11
3.3.3 Checking normal operation .....	3-13
3.3.4 CAL1 execution with PTA .....	3-15
3.3.5 CAL2 execution with PTA .....	3-17
3.4 Measurement .....	3-19
3.4.1 Notes on measurement .....	3-19
3.4.2 Frequency setting .....	3-21
3.4.3 Measurement .....	3-24
3.5 GP-IB Control .....	3-28
3.5.1 Outline of GP-IB .....	3-28

	Page
3.5.2 GP-IB interface functions .....	3-28
3.5.3 Device function codes .....	3-30
3.5.4 Using a device function code .....	3-33
SECTION 4 PRINCIPLES OF OPERATION .....	4-1
SECTION 5 PERFORMANCE CHECK	
5.1 Routine Maintenance and Preventive Maintenance .....	5-1
5.2 Measuring Instruments for Performance Check .....	5-2
5.3 Performance Check .....	5-3
5.3.1 6 dB bandwidth .....	5-3
5.3.2 Noise level .....	5-6
5.3.3 Calibration signal output level .....	5-9
APPENDIX 1 ERROR MESSAGES .....	A-1
APPENDIX 2 EXAMPLE OF CAL1 BASIC PROGRAM WITH GP-IB ....	A-3
APPENDIX 3 EXAMPLE OF CAL2 BASIC PROGRAM WITH GP-IB ....	A-4
APPENDIX 4 MN1602A SET PROGRAM LIST .....	A-9
APPENDIX 5 CONTROLLING THE MP414B LOOP ANTENNA AND MP415B ROD ANTENNA .....	A-10
APPENDIX 6 BYPASS CIRCUIT LOSS CHARACTERISTICS .....	A-11

## SECTION 1

### GENERAL

The MN1602A Programmable Preselector is used to measure electromagnetic interference (EMI) or electrical field strength in combination with the MS2601A Spectrum Analyzer. It is composed of an input amplifier and tuning-type filter.

Low-level signals, pulses, etc. can be measured because the MS2601A improves the sensitivity and eliminates undesired waves to improve the overload characteristics when used with the MN1602A.

The MN1602A can be set manually from the panel or most functions can be externally controlled via the GP-IB. Consequently, the MS2601A and MN1602A frequencies can be fully tracked by using the MS2601A PTA.



SECTION 2

COMPOSITION AND SPECIFICATIONS

2.1 Standard Composition

Table 2-1 lists the standard composition of the MN1602A Programmable Preselector.

Table 2-1 MN1602A Composition

Item	Name	Qty.	Remarks
Instrument	MN1602A Programmable Preselector	1	
Accessories supplied	Coaxial cord S-5DWP•5D-2W•S-5DWP	1	Approx. 0.2 m long
	Coaxial cord 3CA-P2•RG-58A/U•3CA-P2	4	Approx. 0.5 m long
	GP-IB cord	1	Approx. 1 m long
	Power cord	1	Approx. 2.5 m long (with 3 to 2 pole conversion adaptor)
	Fuse	2	T***A 250 V
	Memory card	1	256 k EP-ROM type
	Operation manual	1	W0489AE
Optional accessories	MZ144A Battery pack	1	Lead/acid battery 12 V Output voltaeg: +24 V, -24 V Operation time: Approx. 3 h, Built-in charger
	MZ145A/B DC-DC Converter	1	Input voltage: 10 to 15 V Output voltage: +24 V, -24 V

## 2.2 Specifications

Item	Specifications																				
Combined model	MS2601A Spectrum Analyzer (with PTA-OPT. 01)																				
Frequency range	9 kHz to 2200 MHz																				
Input impedance	50 $\Omega$ , N-type connector VSWR $\leq 1.4$ (ATT $\geq 5$ dB, 9 kHz to 1 GHz) $\leq 1.8$ (ATT $\geq 5$ dB, 1 to 2 GHz)																				
6 dB bandwidth	<table border="1"> <thead> <tr> <th>Frequency range</th> <th>9 to 150 kHz</th> <th>150 kHz to 30 MHz</th> <th>30 to 300 MHz</th> <th>300 to 1000 MHz</th> <th>1 to 2 GHz</th> </tr> </thead> <tbody> <tr> <td>Bandwidth</td> <td><math>\leq 190</math> kHz</td> <td><math>\leq 1.5</math> MHz</td> <td><math>\leq 18</math> MHz</td> <td><math>\leq 28</math> MHz</td> <td><math>\leq 35</math> MHz</td> </tr> </tbody> </table>	Frequency range	9 to 150 kHz	150 kHz to 30 MHz	30 to 300 MHz	300 to 1000 MHz	1 to 2 GHz	Bandwidth	$\leq 190$ kHz	$\leq 1.5$ MHz	$\leq 18$ MHz	$\leq 28$ MHz	$\leq 35$ MHz								
Frequency range	9 to 150 kHz	150 kHz to 30 MHz	30 to 300 MHz	300 to 1000 MHz	1 to 2 GHz																
Bandwidth	$\leq 190$ kHz	$\leq 1.5$ MHz	$\leq 18$ MHz	$\leq 28$ MHz	$\leq 35$ MHz																
Safe input level	130 dB $\mu$ V (+23 dBm), ATT $\geq 20$ dB																				
Input noise level	dB $\mu$ V (ATT = 0 dB, Input level at C/N = 0 dB)																				
	<table border="1"> <thead> <tr> <th>Frequency range</th> <th>9 to 150 kHz</th> <th>150 to 500 kHz</th> <th>0.5 to 30 MHz</th> </tr> </thead> <tbody> <tr> <td>6 dB (bandwidth)</td> <td>(200 Hz)</td> <td></td> <td>(9 kHz)</td> </tr> <tr> <td>Average noise</td> <td><math>\leq -7</math></td> <td><math>\leq -8.5</math></td> <td><math>\leq -13.5</math></td> </tr> <tr> <td>Quasi-peak noise</td> <td></td> <td><math>\leq 0</math></td> <td><math>\leq -5</math></td> </tr> <tr> <td>Spurious</td> <td></td> <td><math>\leq -5</math></td> <td><math>\leq 0</math></td> </tr> </tbody> </table>	Frequency range	9 to 150 kHz	150 to 500 kHz	0.5 to 30 MHz	6 dB (bandwidth)	(200 Hz)		(9 kHz)	Average noise	$\leq -7$	$\leq -8.5$	$\leq -13.5$	Quasi-peak noise		$\leq 0$	$\leq -5$	Spurious		$\leq -5$	$\leq 0$
Frequency range	9 to 150 kHz	150 to 500 kHz	0.5 to 30 MHz																		
6 dB (bandwidth)	(200 Hz)		(9 kHz)																		
Average noise	$\leq -7$	$\leq -8.5$	$\leq -13.5$																		
Quasi-peak noise		$\leq 0$	$\leq -5$																		
Spurious		$\leq -5$	$\leq 0$																		
	<table border="1"> <thead> <tr> <th>Frequency range</th> <th>30 to 300 MHz</th> <th>300 to 1000 MHz</th> <th>1 to 2 GHz</th> </tr> </thead> <tbody> <tr> <td>6 dB (bandwidth)</td> <td></td> <td>(120 kHz)</td> <td></td> </tr> <tr> <td>Average noise</td> <td></td> <td><math>\leq -3</math></td> <td><math>\leq 2</math></td> </tr> <tr> <td>Quasi-peak noise</td> <td></td> <td><math>\leq 6</math></td> <td>-</td> </tr> <tr> <td>Spurious</td> <td></td> <td><math>\leq 10</math></td> <td></td> </tr> </tbody> </table>	Frequency range	30 to 300 MHz	300 to 1000 MHz	1 to 2 GHz	6 dB (bandwidth)		(120 kHz)		Average noise		$\leq -3$	$\leq 2$	Quasi-peak noise		$\leq 6$	-	Spurious		$\leq 10$	
Frequency range	30 to 300 MHz	300 to 1000 MHz	1 to 2 GHz																		
6 dB (bandwidth)		(120 kHz)																			
Average noise		$\leq -3$	$\leq 2$																		
Quasi-peak noise		$\leq 6$	-																		
Spurious		$\leq 10$																			
Gain	Approx. 20 dB																				
Calibration signal generator	Output level: 30 dB $\mu$ V $\pm 1.4$ dB, frequency range $\leq 1000$ MHz																				



Item	Specifications
Input attenuator	0 to 65 dB, 5 dB steps
Monitor	Frequency: 3.6 MHz AM and FM signals can be monitored by a loudspeaker.
External control	Conforms to GP-IB, IEEE488, IEC625-1 (24 poles) Functions other than power switch and FM/AM monitor can be GP-IB controlled. Interface, SH1, AH1, T2, L4, SR1, RL1, PP0, DC1, DT0, and C0
Power supply	AC**V $+10\%$ $-15\%$ (max. 250 V), 48~63 Hz, $\leq 65$ VA DC operation is possible with MZ144A Battery Pack or MZ145A/B DC-DC Converter
Ambient temperature, rated range of use	0°C to 50°C
Dimensions and weight	132.5 H x 284 W x 451 D mm $\leq 13$ kg



## SECTION 3

### OPERATION

#### 3.1 Precautions

##### 3.1.1 Power supply

The MN1602A operates normally at \*\*Vac  $\begin{matrix} +10\% \\ -15\% \end{matrix}$  (max. 250 V),  
48~63 Hz.

---

#### WARNING

---

1. Always ground the ground terminal on the rear panel or the power cord to avoid an electric shock.
  2. Turn the power switch off and disconnect the power cord from the power supply before replacing a fuse.
- 

##### 3.1.2 Environmental conditions

The MN1602A operates normally under ambient temperatures of 0°C to 50°C.

Do not use the unit in locations

1. where vibrations are severe
2. where there is exposure to excessive humidity or dust
3. where there is exposure to direct sunlight
4. where there is exposure to active gases.

---

#### CAUTION

---

If the MN1602A is used at room temperature after an extended use at 0°C or other excessively low temperatures, the circuits may be shorted due to condensation.

Therefore, allow the instrument to become sufficiently dry before turning the power switch on.

---

### 3.1.3 Maximum applied voltage level

---

CAUTION

---

If more than 130 dB $\mu$ V (+23 dBm) signal is applied to the MN1602A input terminal, the circuits may be damaged.

---

### 3.2 Front and Rear Panels

Figures 3-1 and 3-2 show the front and rear panels, respectively. Table 3-1 explains the respective key functions, connectors, and indicators.

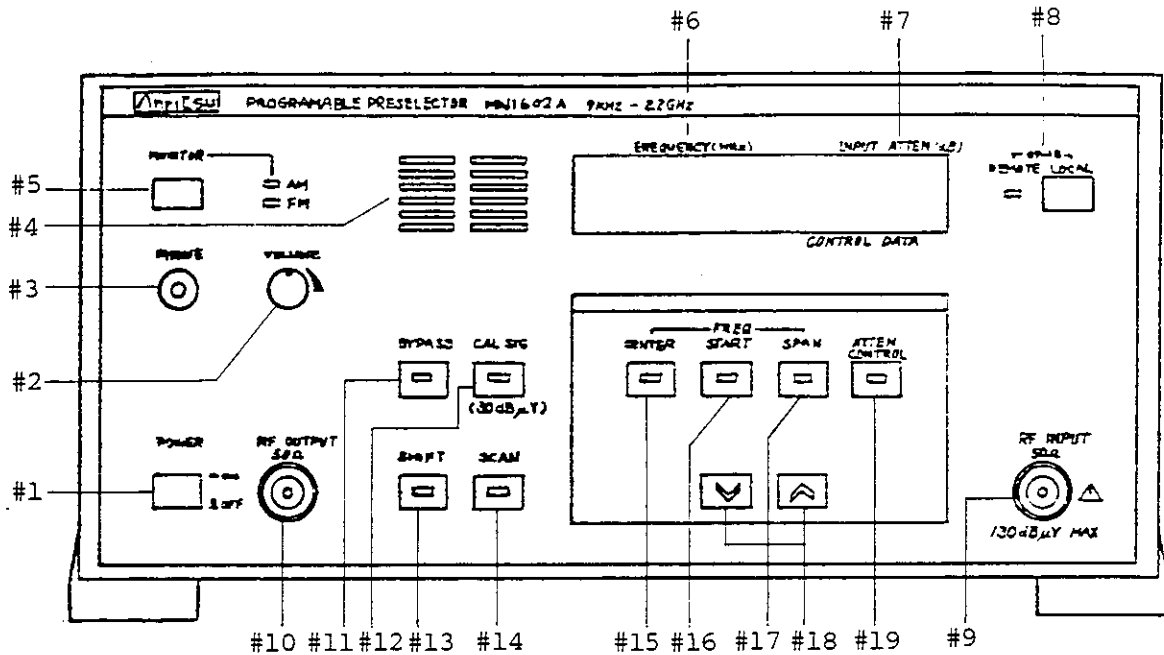


Fig. 3-1 MN1602A Front Panel

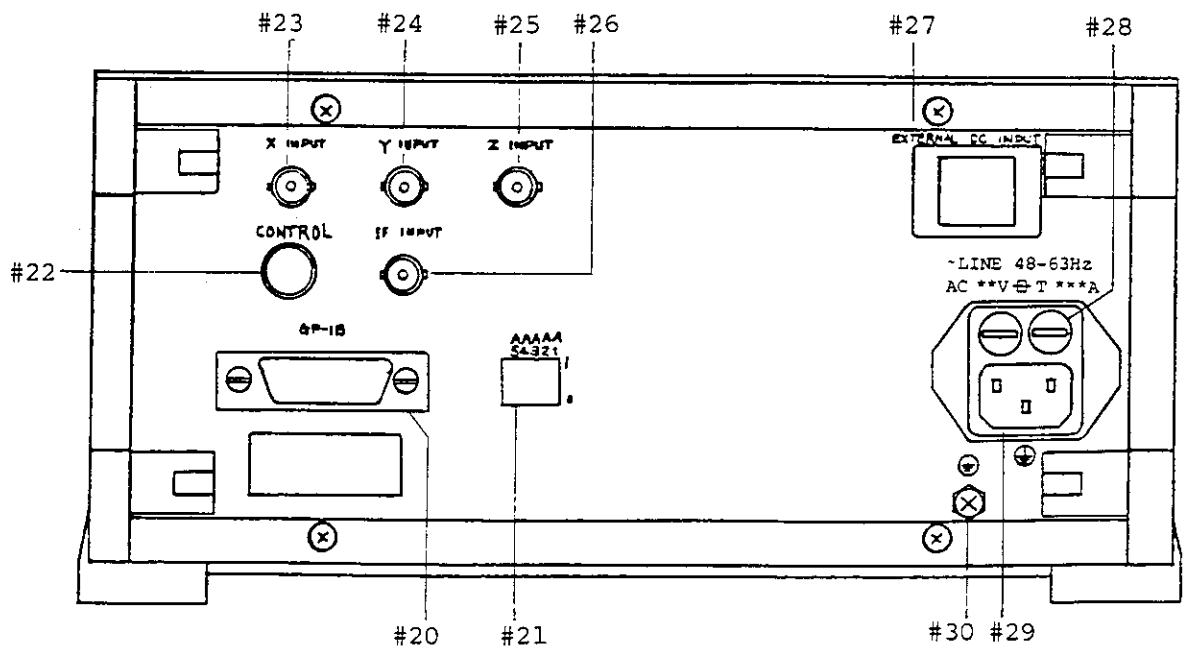


Fig. 3-2 MN1602A Rear Panel

Table 3-1 Front and Rear Panel Functions




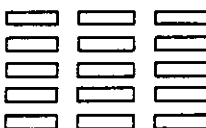
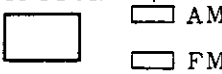

No.	Related panel display	Function
#1	<p>POWER</p> 	Power switch
#2	<p>VOLUME</p> 	Volume control knob for loudspeaker or earphone Cannot be externally controlled
#3	<p>PHONE</p> 	Earphone jack Low-impedance earphone (8 Ω) can be used.
#4		Loudspeaker for sound monitor When a setting error occurs, an alarm sounds.
#5	<p>MONITOR</p> 	Demodulation mode switch The monitor can be manually switched to AM or FM but cannot be externally controlled.
#6	<p>FREQUENCY(MHz)</p> 	Frequency display The start, span, and center frequencies can be displayed with up to 5 digits. The displayed frequency is selected using the frequency selection keys #15, #16, and #17.

Table 3-1 Front and Rear Panel Functions (Continued)


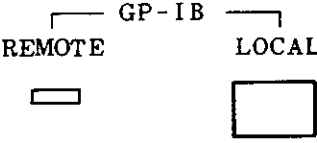
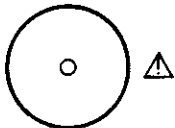
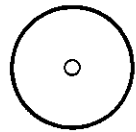

No.	Related panel display	Function
#7	<p data-bbox="379 457 638 485">INPUT ATTEN (dB)</p>  <p data-bbox="384 625 598 655">CONTROL DATA</p>	<p data-bbox="778 409 1364 436">INPUT ATTEN and CONTROL DATA display</p> <p data-bbox="778 436 1460 562">When the ATTEN key is pressed, the attenuation amount is displayed with up to 2 digits. The range from 0 to 65 dB can be changed in 5 dB steps.</p> <p data-bbox="778 562 1348 688">When the SHIFT and CONTROL keys are pressed, F1 to F16 control data corresponding to port 1 to 16 are displayed.</p> <p data-bbox="778 688 1428 756">A 4-bit control signal which corresponds to display #22 is output.</p>
#8		<p data-bbox="778 793 1061 821">Local setting key</p> <p data-bbox="778 821 1444 1012">When the remote state is specified via GP-IB control, the REMOTE lamp comes on. In this state, press the [LOCAL] key to set the MN1602A to the local state. In the local state, the REMOTE lamp goes off and front-panel setting becomes possible.</p>
#9	<p data-bbox="446 1094 590 1144">RF INPUT 50 Ω</p>  <p data-bbox="422 1276 622 1312">130dBμV MAX</p>	<p data-bbox="778 1066 1021 1094">Input connector</p> <p data-bbox="778 1094 1428 1249">Input the signal to be measured in the frequency range from 9 kHz to 2.2 GHz to this connector. The maximum safe input level is 130 dBμV (+23 dBm) and the impedance is 50 Ω (nominal).</p>
#10	<p data-bbox="438 1394 606 1444">RF OUTPUT 50 Ω</p> 	<p data-bbox="778 1367 1037 1394">Output connector</p> <p data-bbox="778 1394 1396 1491">This connector is connected to the spectrum analyzer input terminal. The impedance is 50 Ω (nominal).</p>
#11	<p data-bbox="470 1682 574 1709">BYPASS</p> 	<p data-bbox="778 1640 1085 1667">BYPASS [ON/OFF] key</p> <p data-bbox="778 1667 1460 1793">When BYPASS is ON, the signal input from the MN1602A RF INPUT is output directly to the MN1602A RF OUTPUT without passing through the filter.</p> <p data-bbox="778 1793 1228 1837">"BPS" is displayed at #6.</p>

Table 3-1 Front and Rear Panel Functions (Continued)






No.	Related panel display	Function
#12	<p>CAL SIG                        (30dBμV)</p>	<p>[ON/OFF] key for built-in calibration signal generator                      The calibration signal generator output level is 30 dBμV ±1.4 dB. The calibration signal is amplified by a preselector and is output at RF OUTPUT. In the frequency range from 0.009 to 30 MHz, the frequency is a multiple integer of 50 kHz. In the frequency range from 30 to 1000 MHz, the frequency is a multiple integer of 200 kHz. When ON is set, the input attenuator is set to 0 dB.</p>
#13	<p>SHIFT  </p>	<p>[SHIFT] function key                      This key is used to change the control data.                      When key #19 is pressed after pressing this key, the control data is displayed at #7.</p>
#14	<p>SCAN  </p>	<p>[SCAN] START/STOP key                      The lamp comes on at SCAN ON and the MH1602A and MS2601A are frequency-interlocked.                      Set SCAN OFF to change the frequency (The frequency cannot be changed at SCAN ON).</p>
#15	<p>FREQ                      CENTER  </p>	<p>[CENTER FREQUENCY] setting key                      The MN1602A center frequency is displayed at #6 and is set using the [DOWN and UP] keys #18.</p>
#16	<p>FREQ                      START  </p>	<p>[START FREQUENCY] setting key                      The MN1602A start frequency is displayed at #6 and is set using the [DOWN and UP] keys #18.</p>



Table 3-1 Front and Rear Panel Functions (Continued)

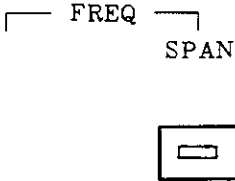


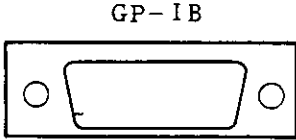
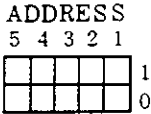
No.	Related panel display	Function
#17		<p>[SPAN FREQUENCY] setting key The MN1602A stop frequency is displayed at #6 and is set using the [UP and DOWN] keys #18.</p>
#18		<p>Setting frequency data, attenuation and control data are set by pressing the [∧] [DOWN] or [∨] [UP] keys after pressing the data setting selection keys #15, #16, #17, and #19. During frequency setting, if the key is held pressed, the fast-forward mode is set and the data is increased or decreased by the preset step amount.</p>
#19		<p>Input attenuator and control data setting key. The MN1602A attenuation value or control data is displayed at #7. Data is set using the [UP and DOWN] keys #18. The control data can be set only when the [SHIFT] key and this key are pressed in this order.</p>
#20		<p>GP-IB connector (IEEE-4888)</p>
#21		<p>Address switch for GP-IB The address is set to 05 at shipment.</p>

Table 3-1 Front and Rear Panel Functions (Continued)






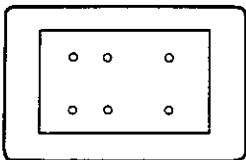

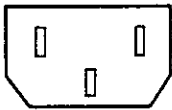

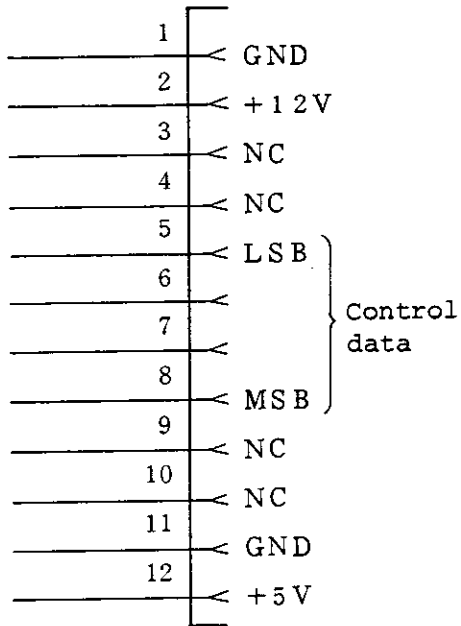
No.	Related panel display	Function
#22	<p>CONTROL</p> 	<p>Control data output connector The control signal for port switching is output at BCD. Any port from 1 to 16 can be selected. Figure 3-3 shows the connector wiring.</p>
#23	<p>X INPUT</p> 	<p>Input terminal for X OUTPUT signal output from the spectrum analyzer</p>
#24	<p>Y INPUT</p> 	<p>Input terminal for Y OUTPUT signal output from the spectrum analyzer</p>
#25	<p>Z INPUT</p> 	<p>Input terminal for Z OUTPUT signal output from the spectrum analyzer</p>
#26	<p>IF INPUT</p> 	<p>Input terminal for IF OUTPUT signal output from the spectrum analyzer. Frequency is 3.6 MHz.</p>
#27	<p>EXTENRRNAL DC INPUT</p> 	<p>Power supply connector for external DC power supply (MZ144A Battery Pack, MZ145A/B DC-DC Converter)</p>

Table 3-1 Front and Rear Panel Functions (Continued)

No.	Related panel display	Function
#28	<p style="text-align: center;">⊖ T 1.6 A</p> 	Fuse holder with ***A fuse
#29	<p style="text-align: center;">~LINE 48-63Hz AC100V</p> 	AC power inlet for AC power source
#30		<p>Cabinet ground terminal This terminal must be connected to ground potential to prevent electric shock.</p>

Control connector wiring



Control data

Control data display	pin PORT	pin			
		8	7	6	5
F1	1	L	L	L	L
F2	2	L	L	L	H
F3	3	L	L	H	L
F4	4	L	L	H	H
F5	5	L	H	L	L
F6	6	L	H	L	H
F7	7	L	H	H	L
F8	8	L	H	H	H
F9	9	H	L	L	L
F10	10	H	L	L	H
F11	11	H	L	H	L
F12	12	H	L	H	H
F13	13	H	H	L	L
F14	14	H	H	L	H
F15	15	H	H	H	L
F16	16	H	H	H	H

Fig. 3-3 Control Connector Wiring and Control Data

Note:

The connector that matches the control connector is model No. HR10-10P-12P (Hirose Electric Company Ltd.).

### 3.3 Measurement Preparation

#### 3.3.1 Power setup

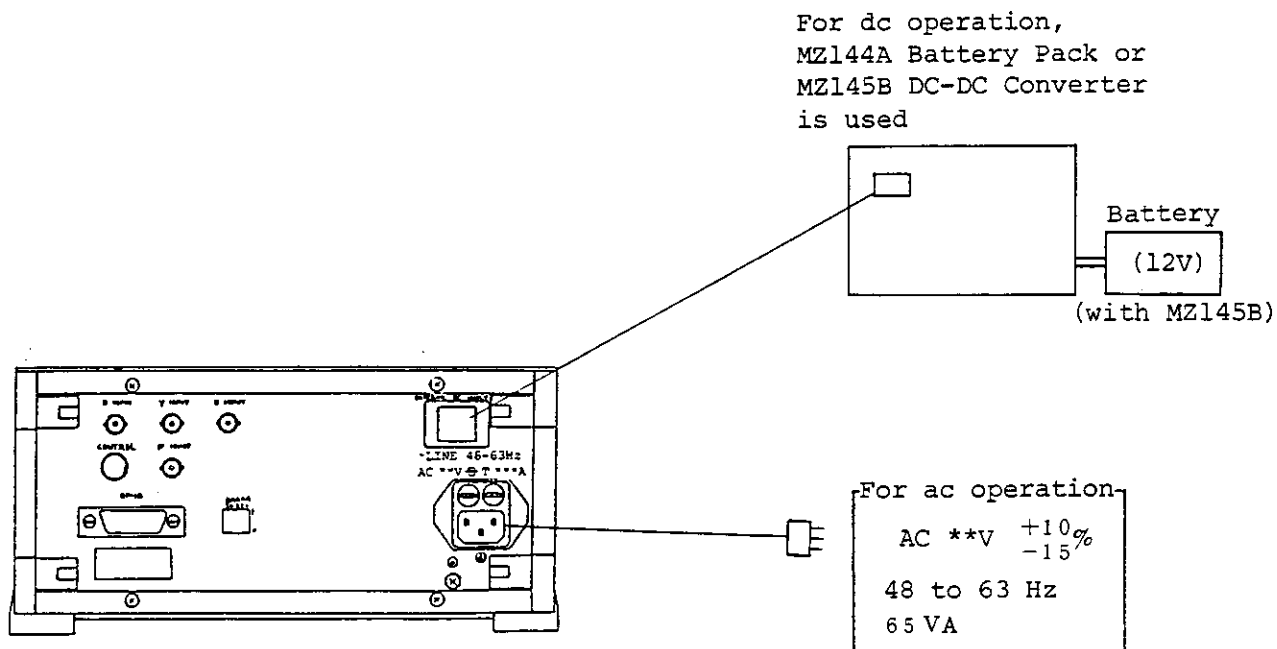


Fig. 3-4 Power Setup

#### Notes:

1. When both AC and DC power are connected, priority is given to dc power.
2. When the MZ144A Battery Pack is used, the MN1602A can be operated for approx. 3 hours.

#### 3.3.2 MN1602A and MS2601A setup

When the MN1602A is operated, first, always connect the MS2601A X, Y, Z, and IF signals and GP-IB connector to the corresponding MN1602A connectors with the supplied cables as shown in Fig. 3-5. Then, connect the MN1602A RF OUTPUT connector and MS2601A RF INPUT connector with the supplied coaxial cables as shown in Fig. 3-6.

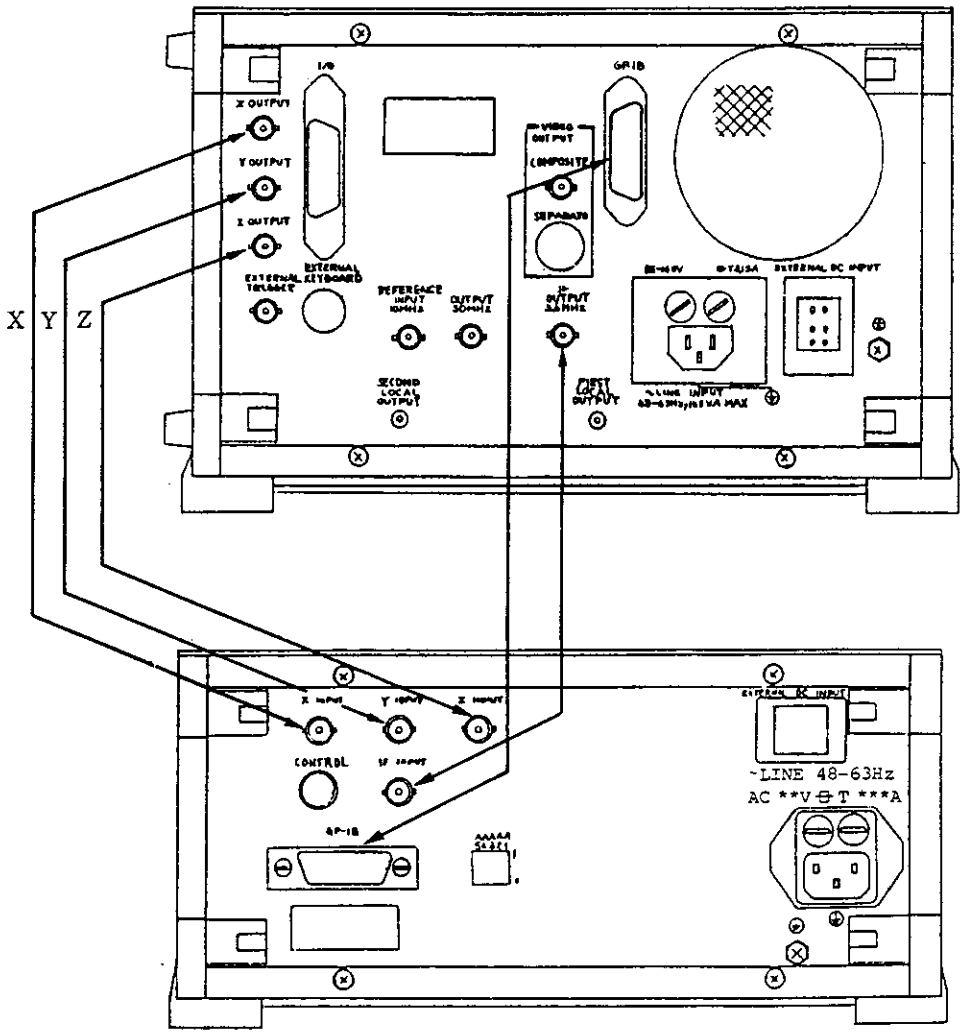


Fig. 3-5 MN1602A and MS2601A Rear Panel Setup

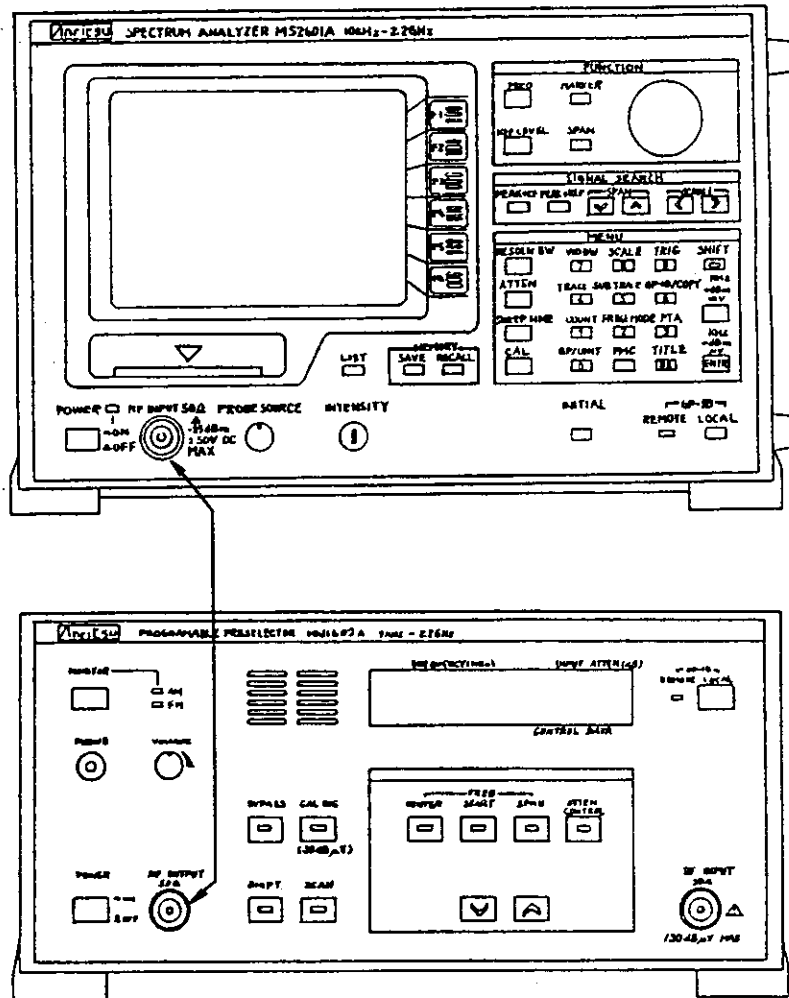


Fig. 3-6 MN1602A and MS2601A Front Panel Setup

### 3.3.3 Checking normal operation

- (1) When connections to the power supply and MS2601A are completed, turn the MS2601A and MN1602A power switches ON.

- (2) Execute the MS2601A ALL CAL and set the MS2601A as shown below after pressing the [INITIAL] key.

CF: 1 MHz                      SWEEP TIME : 200 ms  
 SPAN: 100 kHz                REF LEVEL: 80 dBμV  
 RBW: 3 kHz

- (3) Set the MN1602A center frequency to 1 MHz and the span frequency to 0.1 MHz.
- (4) Press the MH1602A [SCAN] key and check that the [SCAN] key lamp comes ON.
- (5) Press the MN1602A [CAL SIG] key and check that the lamp comes ON.
- (6) The following waveform should appear on the MS2601A CRT.

It is normal if the 1 MHz level is 50 dBμV ±5 dB. If it is abnormal, check the performance.

For the performance check, see SECTION 5.

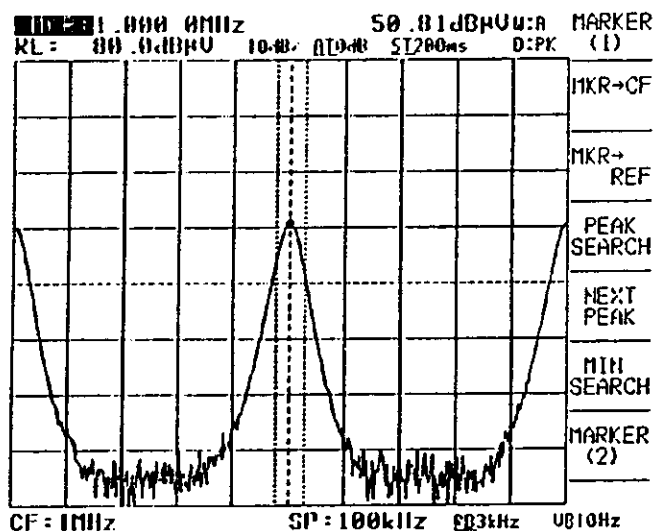


Fig. 3-7 Spectrum at CAL SIG ON



Notes:

1. The MN1602A detects whether the X signal is connected to the MN1602A each time the MS2601A sweeps. Therefore, the following phenomena may occur.
  - a. When the X signal cable is not connected, EE01 is displayed.
  - b. When the Z signal cable is disconnected the Z signal is cutoff, and approx. 2 minutes later EE01 is displayed.
  - c. When the MS2601A is not swept for more than about 2 minutes, EE01 is displayed. If RESTART is set during sweeping, EE01 may also be displayed.
2. When EE01 is displayed, all settings are disabled.

#### 3.3.4 CAL1 execution with PTA

CAL1 is executed for frequency tracking of the MN1602A and MS2601A frequencies.

When CAL1 is executed, the MN1602A receives the X signal from the MS2601A and obtains the voltages corresponding to the MS2601A start and stop frequencies. The frequency tracking is accurately made using this information. If the MS2601A is exchanged, execute CAL1.

Execute CAL1 using the following procedure. Always delete the previous program before executing a program with PTA. (Press the [F1], [DELETE], and [ENTER] keys in this order.)

- (1) Plug the supplied PMC (Plug-in Memory Card) into the MS2601A PMC slot.
- (2) Press the [SHIFT] and [PTA] keys in this order.
- (3) Press the [F2] (PROG LIST) key.

- (4) Press the [F6] (etc.) key and move the cursor to the displayed program name CAL1 using the [F1] (CURSOR UP) or [F2] (CURSOR DOWN) key.
- (5) Load the program by pressing the [F3] (LOAD) key. When the program loading is completed, the cursor moves down.
- (6) When the [F4] (RUN) key is pressed, the program is executed.

The following screen is displayed during program execution.

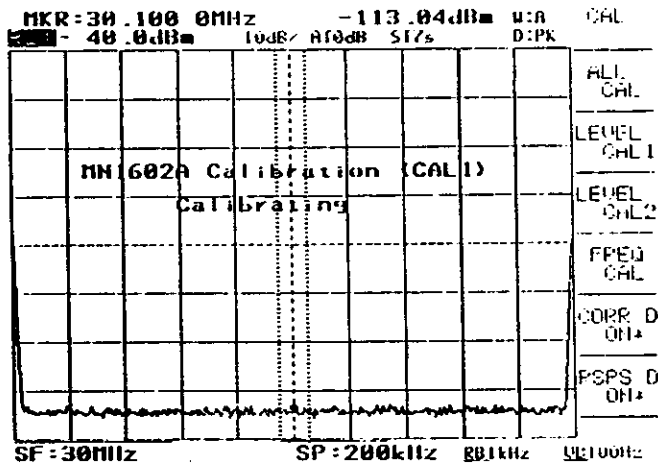


Fig. 3-8 Waveform during CAL1 Execution

- (7) When CAL1 is completed, the following message appears.

\*\*\* Calibration End !!! \*\*\*

Note:

When initialization is made during PTA execution, initialize after presetting.

### 3.3.5 CAL2 execution with PTA

When the ambient temperature changes excessively the center frequency of the tuning-type filter in the MN1602A changes. As a result, the tuning-type filter loss increases.

CAL2 is executed to obtain the optimum control voltage of the tuning-type filter in the usage environment. When CAL2 is executed, the tuning-type filter control voltage is determined at all the specified frequency points within a frequency range of 150 kHz to 1000 MHz. The newly-determined data is stored and the previous data is erased. The control value for room temperature is stored at shipment.

Execute CAL2 when the ambient temperature changes by approx. 10°C.

- (1) Plug supplied PMC into the MS2601A PMC slot.
- (2) Press the [SHIFT] and [PTA] keys in this order.
- (3) Press the [F2] (PROG LIST) key.
- (4) Press the [F6] (etc) key and move the cursor to the displayed program name CAL2 using the [F1] (CURSOR UP) or [F2] (CURSOR DOWN) key.
- (5) Load the program by pressing the [F3] (LOAD) key.
- (6) When the [F4] (RUN) key is pressed, the program is executed.

CAL2 execution is shown as "\*\*\*\*\*" number on the calibrating display.

As CAL2 proceeds, the number of \* symbols decreases.  
When CAL2 is completed, the following message is displayed.

\*\*\* Calibration End !!! \*\*\*

It takes approx. 3 1/2 minutes to complete CAL2  
execution.

### 3.4 Measurement

When the MN1602A is used, especially, at low level or interference wave measurement, the MN1602A is tracked to the MS2601A frequency. In other cases, bypass the MN1602A and measure using only the MS2601A.

When measurement is made with the frequencies tracked, the input level must be determined from the MN1602A gain at the MS2601A indicated value and the measured frequency after calibrating the MS2601A. The MN1602A gain is approx. 20 dB and varies with the frequency. Therefore, the MN1602A gain must be determined for the measured frequency.

The MN1602A has a built-in calibration signal generator with very stable and flat frequency characteristics to determine the gain correction value.

This signal is received by the MS2601A and the gain correction value is obtained from the difference between the indicated value and the calibration signal generator level.

When level is measured with the MN1602A, there is basically no change made to the MS2601A level setting and the level is adjusted with the MN1602A input attenuator so that the indicated value can be set within the specified range.

#### 3.4.1 Notes on measurement

- (1) Since the MN1602A frequency band is divided as shown in Table 3-2, set the frequency within the band. However, if the set frequency maximum value is within the overlap frequency, the band is not switched. Set the span width to 200 MHz or less. If it is set to more than 200 MHz, the turning-type filter loss becomes big.

- (2) If the frequency setting range covers two or more of the MN1602A bands, noise is generated at the band-switching frequency. When the frequency is set across two bands, the frequency indication blinks.
- (3) Set the MS2601A SWEEP TIME to 200 ms or more. If it is set to less than 200 ms, the tuning-type filter loss becomes big.
- (4) When CAL SIG is set to ON, always set the MS2601A SWEEP TIME to 200 ms or more.
- (5) When the MS2601A zone sweep is used, bypass the MN1602A.
- (6) Calibrate a gain of more than 1000 MHz using an external signal generator.





Table 3-2 MN1602A Frequency Bands

Band	Frequency range	Overlap frequency
1	9 to 150 kHz	—
2	150 to 500 kHz	500 to 520 kHz
3	500 to 1800 kHz	1800 to 1820 kHz
4	1.8 to 3.7 MHz	3.7 to 3.75 MHz
5	3.7 to 7 MHz	7 to 7.1 MHz
6	7 to 12 MHz	12 to 12.2 MHz
7	12 to 19 MHz	19 to 19.4 MHz
8	19 to 30 MHz	30 to 30.4 MHz
9	30 to 50 MHz	50 to 51 MHz
10	50 to 90 MHz	90 to 91 MHz
11	90 to 160 MHz	160 to 161 MHz
12	160 to 300 MHz	300 to 302 MHz
13	300 to 400 MHz	400 to 404 MHz
14	400 to 1000 MHz	—
15	1000 to 2200 MHz	—

### 3.4.2 Frequency setting

To track the MN1602A with the MN1601A, it is necessary to set the same frequency for the MN1602A as that of the MS2601A. There are three ways to set the MN1602A frequency: setting with panel keys, setting with PTA, and setting with external controller. When the PTA frequency tracking program is executed, the MN1602A frequency can be set by setting the frequency using the MS2601A panel keys.

#### (1) Setting with panel keys

- (a) Set the [SCAN] key so the lamp is off.
- (b) Select either one of the two frequency setting modes (center frequency/span frequency or start frequency/span frequency) according to the MS2601A setting mode.
- (c) Press the [CENTER] or [START] key.
- (d) Set the mode to the MS2601A center frequency or start frequency using the [  ] or [  ] keys.
- (e) Press the [SPAN] key.
- (f) Set the mode to the MS2601A span frequency using the [  ] or [  ] key.
- (g) When setting is completed, press the [SCAN] key; the [SCAN] key lamp will come on. The MN1602A frequency is then tracked to that of the MS2601A.

#### Note:

The MN1602A center and start frequencies may not coincide with those of the MS2601A because the setting resolution is limited. However, since the MN1602A passband is bigger than the setting resolution, there will be no problem if the value nearest to the MS2601A frequency is set at the MN1602A.

(2) Setting with PTA

There are two settings for the supplied frequency tracking program (File name: AUTO); 1. Arbitrary frequency setting, 2. Setting with MN1602A band.

- (a) Plug the supplied PMC into the MS2601A PMC slot.
- (b) First, turn the MN1602A power on and then turn the MS2601A power on. The frequency tracking program automatically starts running and the function menu changes to the one shown in Fig. 3-9.

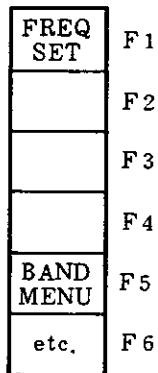


Fig. 3-9 Function Key Menu

Note:

If the MS2601A ST (SWEEP TIME) is 5 S or more, the MN1602A "EE01" may not be released and the program may exit from the RUN state.

In this case, set ST to less than 5 S and perform items (a) and (b) again.



1. When arbitrary frequency is set:
  - a. Set the MS2601A center frequency/span frequency or start frequency/span frequency using the ten keys or knob.
  - b. When pressing the [F1] (FREQ SET) key, the frequency will be set at the MN1602A.
  
2. When the frequency corresponds to the MN1602A band set:
  - a. Press the [F5] (BAND MENU) key. The frequency range of each band shown in Table 3-2 is displayed on the CRT as soon as the function menu changes to the menu shown in Fig. 3-10.

UP	F1
DOWN	F2
	F3
	F4
FPEQ SET	F5
etc.	F6

Fig. 3-10 Function Key Menu

- b. Select the required band item number using the [F1] (UP) and [F2] (DOWN) keys.
- c. If press the [F5] [FREQ SET] key, the frequency of the displayed band will be set at the MN1602A.

Note:

If the setting is made across two or more bands, |||CROSS BAND||| is displayed on the MS2601A CRT.

(3) Setting with external controller

The frequency is set at the MN1602A and MS2601A from the external controller using the GP-IB.

Appendix 4 describes program examples.

3.4.3 Measurement

Connect a signal output connector of the artificial mains network or antenna connector to the MN1602A RF INPUT connector using a coaxial cable.

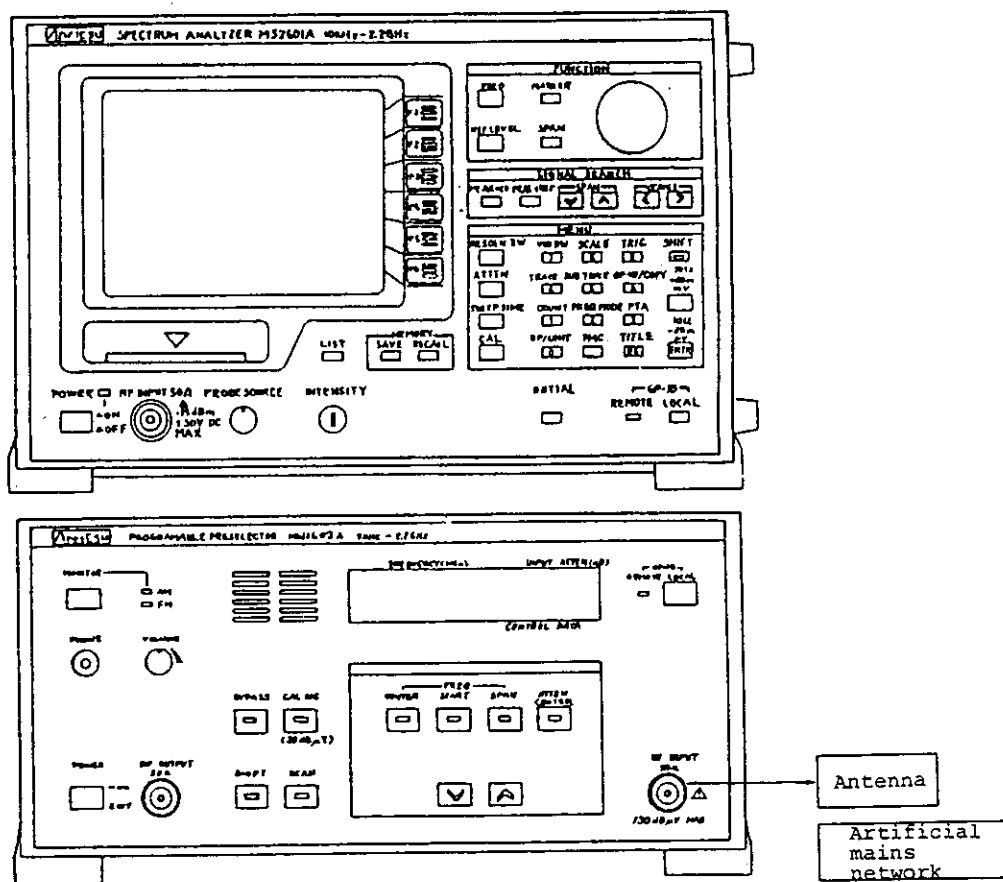


Fig. 3-11 Measured Signal Setup

Basically, measurement is performed according to the following procedures.

- (1) Set the MN1602A BYPASS to ON. Examine the distribution of interference waves using only the MS2601A and determine the approximate values for the measuring frequency and level.
- (2) Set the MN1602A BYPASS to OFF. Set the frequency determined in item (1) at the MN1602A and MS2601A, then track the frequencies.
- (3) Set the detection mode (DET PEAK or QP).
- (4) Change the MN1602A input attenuator and read the indicated level.
- (5) Determine the MN1602A gain correction.
- (6) The input level is expressed as follows:  
Input level = MS2601A indicated value + attenuation of the MN1602A attenuator + MN1602A gain correction value

(1) Determining gain correction

- (a) Set the MS2601A INPUT REF level to 67 dB $\mu$ V and ATTEN to 0 dB.
- (b) Press the MN1602A [CAL SIG] key so the lamp goes on. The calibration signal generator signal level is 30 dB $\mu$ V  $\pm$ 1.4 dB. This is amplified by approx. 20 dB so that approx. 50 dB $\mu$ V is output from the MN1602A.
- (c) Since a calibration signal is displayed on the MS2601A CRT, match the marker to the peak point nearest to the measured frequency and read the level. This value will be A (dB $\mu$ V).

(d) The gain correction is determined as follows:

$$\text{Gain correction} = 30 - A \text{ (dB)}$$

Notes:

1. When the gain correction is obtained, set the MS2601A RBW to 10 kHz or less (200 kHz at 6 dB BW) at less than 30 MHz and 30 kHz or less (9 kHz or 120 kHz at 6 dB BW) at more than 30 MHz. The gain correction is valid only when the input level is measured at the BW where the gain correction was determined.
2. When the span is 0, if the frequency is different from that of the calibration signal generator, match the frequency to the nearest calibration frequency and determine the gain correction. Then, return the frequency to the original setting.
3. If the frequency setting range covers two or more of the calibration signal generator bands, SCAN will be turned off when approx. 200 sweeps have been performed after [CAL SIG] key is turned on.

(2) Measurement in peak mode

For measurement in the peak detection mode or average detection mode (averaging by turning on the VIDEO filter), set the MS2601A to DET PEAK.

(a) Set the MS2601A as follows:

REF LEVEL: 90 dB $\mu$ V

ATTEN: 0 dB

(b) Adjust the attenuation amount using the MN1602A [ATTEN] key so that the MS2601A indicated level is within the CRT display range.

(c) Calculate the input level from the MN1602A gain correction and attenuation.

(3) Measurement in Q. PEAK mode

For measurement in the Q. PEAK (QP ON) mode, set the MS2601A detection mode to Q. PEAK (QP ON). Adjust the MN1602A input attenuator so that the measurement level is within the specified range as shown in paragraph (c) below.

(a) Set the MS2601A as shown in Table 3-3.

Table 3-3 MS2601A Setting

Frequency range	9 kHz to 150 kHz	150 kHz to 30 MHz	30 MHz to 1000 MHz
INPUT ATT (dB)	0	0	0
RBW (Hz)	200	9 k	120 k
REF LEVEL (dB $\mu$ V)		67	
SPAN		0	

(b) Set the MS2601A detection mode to Q. PEAK (QP ON).

(c) Adjust the MN1602A attenuation using the MN1602A [ATTEN] key so that the MS2601A level marker is between 32 dB $\mu$ V and 27 dB $\mu$ V ( $\triangleright$  point).

(d) Determine the MN1602A gain correction and calculate the input level.

### 3.5 GP-IB Control

#### 3.5.1 Outline of GP-IB

The MN1602A has a GP-IB (General Purpose Interface Bus) interface.

The GP-IB is an interface bus for measurement standardized by IEEE-4888 (Institute of Electrical and Electronic Engineers) or IEC-625 (International Electrotechnical Commission). The MN1602A has the following GP-IB functions.

- (1) Control of all functions except power switch, [LOCAL] key, and MONITOR related functions
- (2) Interrupt function and serial poll operation
- (3) Automated measurement when configured with personal computer and other measuring instruments

#### 3.5.2 GP-IB interface functions

Table 3-4 lists the MN1602A GP-IB interface functions.

Table 3-4 MN1602A GP-IB Interface Functions

Code	Interface function	Remarks
SH1	All source handshake functions provided	The data can be sent
AH1	All accept handshake functions provided	The data can be received
T2	Basic talker function provided Serial poll function provided Talk-only function not provided MLA talker release function not provided	The serial poll function can be used
L4	Basic listener function provided Listen-only function not provided MTA listener release function provided	The listener function can be used
SR1	All service request functions provided	The interrupt function can be used
RL1	All remote/local functions provided	The local lockout function can be used
PP0	Parallel poll function not provided	
DC1	All device clear functions provided	The device clear function can be used
DT0	Device trigger function not provided	
C0	Controller function not provided	

### 3.5.3 Device function codes

Table 3-5 lists the device function codes.

Table 3-5 Device Function Codes

	Function	Device function code
UNIT	Hz	HZ
	kHz	KZ
	MHz	MZ
	GHz	GZ
FREQUENCY	Set start frequency	ST
	Set span frequency	SP
	Set center frequency	CN
ATTENUATOR	Set INPUT ATTEN to 0 dB	A0
	Set INPUT ATTEN to 5 dB	A5
	Set INPUT ATTEN to 10 dB	A10
	Set INPUT ATTEN to 15 dB	A15
	Set INPUT ATTEN to 20 dB	A20
	Set INPUT ATTEN to 25 dB	A25
	Set INPUT ATTEN to 30 dB	A30
	Set INPUT ATTEN to 35 dB	A35
	Set INPUT ATTEN to 40 dB	A40
	Set INPUT ATTEN to 45 dB	A45
	Set INPUT ATTEN to 50 dB	A50
	Set INPUT ATTEN to 55 dB	A55
	Set INPUT ATTEN to 60 dB	A60
Set INPUT ATTEN to 65 dB	A65	
CALIBRATION	Obtain frequency correction value from spectrum analyzer X OUT signal	C1
	Obtain tuning-type filter control value for each MN1602A band	C2
	Terminate C2.	CE



Table 3-5 Device Function Codes (Continued)

	Function	Device function code
SG	Turn calibration signal generator on	P1
	Turn calibration signal generator off	P0
SCAN	Start scan	S1
	Stop scan	S0
BYPASS	Set bypass	B1
	Release bypass	B0
PORT	Select PORT 1	T1
	Select PORT 2	T2
	Select PORT 3	T3
	Select PORT 4	T4
	Select PORT 5	T5
	Select PORT 6	T6
	Select PORT 7	T7
	Select PORT 8	T8
	Select PORT 9	T9
	Select PORT 10	T10
	Select PORT 11	T11
	Select PORT 12	T12
	Select PORT 13	T13
	Select PORT 14	T14
	Select PORT 15	T15
	Select PORT 16	T16
SRQ MASK	Mask all SRQs 20-to-5 bit	AM
	Release mask only 3-bit SRQ	M3
	Release mask only 4-bit SRQ	M4
	Release mask only 5-bit SRQ	M5

Table 3-6 lists the status message line allocations.

Table 3-6 Status Message Line Allocation

Value	Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Line	DIO8	DIO7	DIO6	DIO5	DIO4	DIO3	DIO2	DIO0
1	x		Performs service request	ERROR (Abnormal state)	BUSY (in process)	CAL1 and CAL2 terminated	UNCAL state	x	When EEO1 occurs
0	x		Does not perform service request	NO ERROR (normal state)	READY (ready state)	CAL1 and CAL2 not terminated	States other than UNCAL	x	When no EEO1
Weight		128	64	32	16	8	4	2	1
Sending		0	1 / 0	1 / 0	1 / 0	1 / 0	0	0	0

x: Unused and 0

#### . SRQ BUSY/READY

The SRQ conditions for BUSY/READY (status bit 6) are moved to the following:

- (1) CAL in progress
- (2) SCAN in progress
- (3) Parameter change executed

At this time, the status bit 4 is set to "1". Bit 4 is reset after items (1) to (3) are completed.

#### . SRQ MASK

Mask and mask clear can be set in bit units for the SRQ status bits 3 to 5 by the following GP-IB commands.

- "AM" .... Masks all SRQs from bits 3 to 5.
- "M3" .... Releases only bit 3 SRQ mask
- "M4" .... Releases only bit 4 SRQ mask
- "M5" .... Releases only bit 5 SRQ mask

If a device clear is sent from the controller to the MN1602A, the MN1602A is set as shown in Table 3-7.

Table 3-7 Setting when Device Clear Sent to MN1602A

Item	Setting
INPUT ATTEN	10 dB
START FREQ	30 MHz
SPAN FREQ	970 MHz
BYPASS	OFF
SCAN	OFF
CAL SIG	OFF
PORT	1

#### 3.5.4 Using a device function code

The program examples given below are for executing each function using a device function code.

These program examples are for the Anritsu Packet IIe/III/V personal technical computer series.

The MN1602A GP-IB address is 05.

- (1) Program example to set start frequency to 150 kHz and span frequency to 350 kHz

```
WRITE @ 105: "S0"  
WRITE @ 105: "ST150KZ"  
WRITE @ 105: "SP350KZ"  
WRITE @ 105: "S1"
```

- (2) Program example to set center frequency to 1 MHz and span frequency to 100 kHz

```
WRITE @ 105: "S0"  
WRITE @ 105: "CN1MZ"  
WRITE @ 105: "SP100KZ"  
WRITE @ 105: "S1"
```

- (3) Program example to set 10 dB attenuation

```
WRITE @ 105: "A10"
```

- (4) Program example to turn on calibration signal

```
WRITE @ 105: "P1"
```

- (5) Program example to turn off calibration signal

```
WRITE @ 105: "P0"
```

- (6) Basic program example to execute CAL1 (See Appendix 2)

CAL1 executes the following program after the settings shown in Table 3-8 are set on the MS2601A.

```
WRITE @ 105: "C1"  
DO  
STATUS @ 105: STS  
EXIT IF (BIT (3, STS) = 1 OR BIT (5, STS) = 1)  
AND BIT (6, STS) = 1 OR BIT (4, STS) = 0  
AND BIT (6, STS) = 1  
LOOP
```

Table 3-8 MS2601A Setting

Item	Setting
Center frequency	30.000 MHz
Span	200 kHz
RBW/VBW	1 kHz/100 Hz
SWEEP TIME	7 S

- (7) Basic program examples to execute CAL2  
(See Appendix 3)

CAL2 determines the tuning-type filter control value at each calibration frequency after the settings shown in Table 3-9 are set on the MS2601A. Perform the following program examples for all the calibration frequencies.

```

WRITE @ 105: "0.15MZ"
WRITE @ 105: "C2"
DO
STATUS @ 105: STS
EXIT IF (BIT (3,STS) = 1 OR BIT (5, STS) = 1)
      AND BIT (6, STS) = 1 OR BIT (4, STS) = 0
      AND BIT (6, STS) = 1
LOOP

```

Execute the following command after the above programs are completed.

```

WRITE @ 105: "CE"

```

Table 3-9 MS2601A Setting

Item	Setting
REF LEVEL	-15 dBm
Center frequency	Calibration frequency
Span	Zero
ATTEN	0 dB
SWEEP TIME	100 S
RBW/VBW	0.15 to 1.6 MHz : 3 kHz/100 Hz
	1.6 to 90 MHz : 3 kHz/100 Hz
	90 to 1000 MHz : 10 kHz/100 Hz

(8) Program example to turn bypass on

WRITE @ 105: "B1"

(9) Program example to turn bypass off

WRITE @ 105: "B0"

(10) Program example to set PORT 1 as control output.

WRITE @ 105: "T1"

SECTION 4  
PRINCIPLES OF OPERATION

Fig. 4-1 shows the MN1602A block diagram.

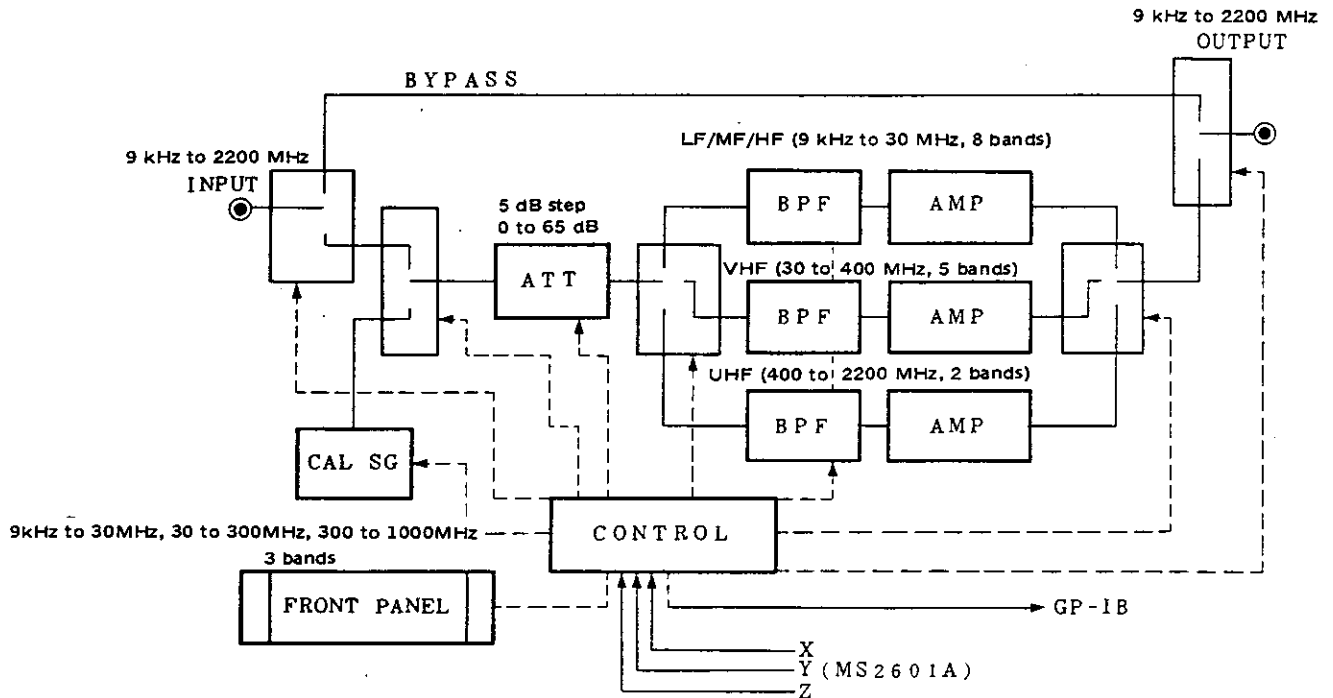


Fig. 4-1 Block Diagram

The signal applied to INPUT is passed through ATT and a BPF (tuning-type filter) and amplified by an AMP (amplifier), then outputs at OUTPUT.

ATT can be changed in 5 dB steps so that the receiving system such as AMP or the MS2601A operates at the optimum point without saturation when an impulse signal is measured.

The BPF eliminates desired signals by using a tuning-type filter with a center frequency which changes in tracking with the MS2601A sweep signal. A high-Q circuit is used to reduce the impulse signal peak value.

The AMPs are composed of a wide-band amplifier with a low NF to obtain high sensitivity. The gain of the entire circuit from INPUT to OUTPUT is adjusted to approx. 20 dB.

CAL SG consists of a PG that generates a narrow pulse and this PG generates higher-harmonic signals with a uniform amplitude in the used frequency range. This signal is used to calibrate the level and frequency. The pulse repetition frequency of the CAL SG is switched by the measurement frequency for use.

The MN1602A is tracked with the MS2601A via the X, Y, and Z signals.



SECTION 5  
PERFORMANCE CHECK

5.1 Routine Maintenance and Preventive Maintenance

The main purpose of calibration and the performance check is to prevent the MN1602A performance from deterioration.

For this reason, the MN1602A should be used daily under the correct environmental conditions (paragraph 3.1.2) and in accordance with the appropriate operations instructions. The best preventive maintenance is to use the MN1602A correctly and to carry out periodic calibration and performance checks.

Table 5-1 describes the routine maintenance.

Table 5-1 Routine Maintenance

	Period	Maintenance
External soiling	<ul style="list-style-type: none"> <li>. Before long-term storage</li> <li>. When used in dusty place</li> <li>. When foreign matter enters cabinet</li> </ul>	Wipe off dirt using soapy water or propriety cleaners.
Dust accumulation	<ul style="list-style-type: none"> <li>. When dust accumulates in housing</li> </ul>	Open the cabinet and blow the dust out using compressed air.
Lubrication	Not necessary	
Loose fittings such as screws	When found	Tighten using correct tools.

\* Solvents such as thinners or benzine may damage the surface.

## 5.2 Measuring Instruments for Performance Check

Table 5-2 lists measuring instruments required for performance check.

Table 5-2 Measuring Instrument Required for Performance Check

Check item	Measuring instrument	Main performance	Recommended model	Reference
6 dB bandwidth	Network analyzer	10 Hz to 30 MHz	MS420K	Paragraph 5.3.1
	Tracking generator	20 kHz to 2 GHz -59 to 0 dBm	MH672A	
	Spectrum analyzer	10 kHz to 2.2 GHz	MS2601A	
Noise level	Signal generator	100 kHz to 2 GHz	MG649A	Paragraph 5.3.2
Calibration signal output level	Signal generator	100 kHz to 2 GHz	MG649A	Paragraph 5.3.3

### 5.3 Performance Check

When the performance check is used to confirm the performance at acceptance, at periodical calibration, or after repair, carry out the test according to paragraphs 5.3.1 to 5.3.3.

A periodic check for preventive maintenance should be carried out for the items judged important.

#### Note:

Always use the MS2601A for the MN1602A performance check. The performance cannot be tested using only the MN1602A.

#### 5.3.1 6 dB bandwidth

Check that 6 dB bandwidth is equal to or less than the value in the test objective specifications in item (1).

##### (1) Test objective specifications

Frequency range	9 to 150 kHz	150 kHz to 30 MHz	30 to 300 MHz	300 to 1000 MHz	1 to 2 GHz
Bandwidth	$\leq 190$ kHz	$\leq 1.5$ MHz	$\leq 18$ MHz	$\leq 28$ MHz	$\leq 35$ MHz

##### (2) Measuring instruments required for test

Tracking generator: MH672A  
Spectrum analyzer: MS2601A  
Network analyzer: MS420K

(3) Setup

(a) For 9 to 150 kHz:

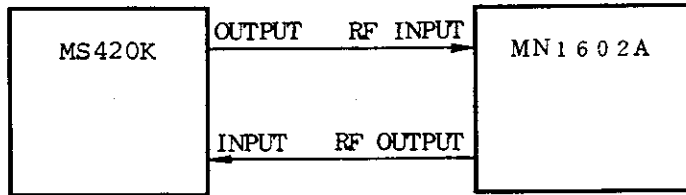


Fig. 5-1 6 dB BW Test at 9 to 150 kHz

(b) For 150 kHz to 2 GHz:

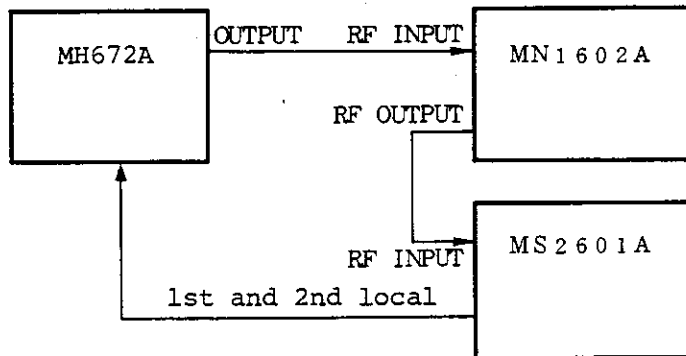


Fig. 5-2 6 dB BW Test at 150 kHz to 2 GHz

(4) Test procedures

(a) For 9 kHz to 150 kHz

STEP	PROCEDURE
1	Set the MN1602A as follows: INPUT ATTEN: 0 dB Center frequency: 100 kHz Span: 0 Hz

(Continued)

---

STEP	PROCEDURE
2	Set the MS420K as follows: Output level: -30 dBm Start frequency: 1 kHz Stop frequency: 200 kHz
3	Read the frequency at two points 6 dB below the 100 kHz level and check that the frequency difference is 190 kHz or less.

---

(b) For 150 kHz to 2 GHz

---

STEP	PROCEDURE
1	Set the MN1602A as follows: INPUT ATTEN: 0 dB Center frequency: 29.9 MHz Span: 0 Hz
2	Set the MS2601A as follows: REF LEVEL: 85 dB $\mu$ V (-22 dBm) Center frequency: 29.9 MHz Span frequency: 5 MHz
3	Set the MH672A output level to -50 dBm.
4	Read the frequencies at two points 6 dB below the peak point and check that the frequency difference is 1.5 MHz or less.
5	Repeat steps 1 to 4 for center frequencies of 299.9 MHz, 999.9 MHz, and 2000 MHz. However, set the MS2601A span frequency to 50 MHz. Check that the values are within the test objective specifications shown in item (1).

---

### 5.3.2 Noise level

The noise level test checks that the input level at C/N = 0 dB is the value or less than that shown in the test objective specifications (item (1)).

#### (1) Test objective specifications

Frequency range	9 to 150 kHz	150 to 500 kHz	0.5 to 30 MHz	30 to 300 MHz	300 to 1000 MHz	1 to 2 GHz
6 dB bandwidth	(200 Hz)	(9 kHz)			(120 kHz)	
Average noise dB $\mu$ V	$\leq -7$	$\leq -8.5$	$\leq -13.5$	$\leq -3$		$\leq 2$
Quasi-peak noise dB $\mu$ V		$\leq 0$	$\leq -5$	$\leq 6$		—

#### (2) Measuring instrument required for performance check

Reference signal generator: MG649A

#### (3) Setup

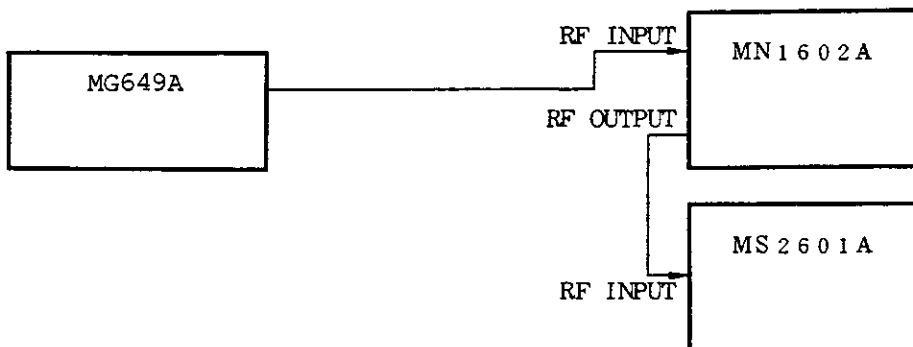


Fig. 5-3 Noise Level Test

(4) Test procedures

STEP	PROCEDURE
1	Set the MN1602A and MS2601A INPUT ATTEN to 0 dB and span to 0.
2	Set 100 kHz at the MG649A, MN1602A, and MS2601A.
3	Set the MS2601A to the values given in the average noise measurement shown in Table 5-3. Set VBW to 1 Hz and REF LEVEL to 20 dB $\mu$ V (-87 dBm).
4	Turn the MG649A output off (or shift the frequency by 1 MHz) and read the MS2601A indicated level.
5	Turn the MG649A output on (match the frequency) and read the MG649A output level when the MS2601A indication is 3 dB larger than that in step 4.
6	Repeat steps 2 through 5 for the test frequencies shown in Table 5-3.
7	Turn Q. PEAK on and repeat steps 2 through 5 for the test frequencies (up to 1000 MHz) shown in Table 5-3.

Table 5-3 Test Frequency and MS2601A Setting

Test frequency	MS2601A setting				REF level
	BW	Average noise measurement	Quasi-peak noise measurement	VBW	
1	100 kHz	200 Hz	1 Hz	OFF	20 dB $\mu$ V (-87 dBm)
2	150 kHz	9 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
3	500 kHz	9 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
4	1.8 MHz	9 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
5	3.7 MHz	9 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
6	7 MHz	9 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
7	12 MHz	9 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
8	19 MHz	9 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
9	30 MHz	120 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
10	50 MHz	120 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
11	90 MHz	120 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
12	160 MHz	120 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
13	300 MHz	120 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
14	400 MHz	120 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
15	1000 MHz	120 kHz	1 Hz	OFF	30 dB $\mu$ V (-77 dBm)
16	2000 MHz	120 kHz	1 Hz	-	30 dB $\mu$ V (-77 dBm)



### 5.3.3 Calibration signal output level

The calibration signal output level test checks that the input noise level with [CAL SIG] ON is within the range of the test objective specifications shown in item (1).

(1) Test objective specifications

Calibration signal output level:  $30 \text{ dB}\mu\text{V} \pm 1.4 \text{ dB}$

(2) Measuring instrument required for performance check:

Signal generator: MG649A

(3) Setup

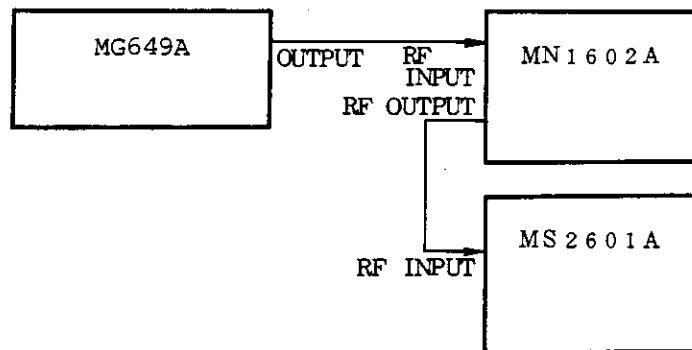


Fig. 5-4 Calibration Signal Output Level Test

(4) Test procedure

---

STEP	PROCEDURE														
1	Set the MN1602A and MS2601A as follows: <table><tbody><tr><td>[MN1602A]</td><td>[MS2601A]</td></tr><tr><td>INPUT ATTEN: 0 dB</td><td>REF level: 67 dB<math>\mu</math>V</td></tr><tr><td>Span: 0</td><td>(-40 dBm)</td></tr><tr><td></td><td>INPUT ATTEN: 0 dB</td></tr><tr><td></td><td>Span: 0</td></tr><tr><td></td><td>RBW: 10 kHz</td></tr><tr><td></td><td>VBW: 100 Hz</td></tr></tbody></table>	[MN1602A]	[MS2601A]	INPUT ATTEN: 0 dB	REF level: 67 dB $\mu$ V	Span: 0	(-40 dBm)		INPUT ATTEN: 0 dB		Span: 0		RBW: 10 kHz		VBW: 100 Hz
[MN1602A]	[MS2601A]														
INPUT ATTEN: 0 dB	REF level: 67 dB $\mu$ V														
Span: 0	(-40 dBm)														
	INPUT ATTEN: 0 dB														
	Span: 0														
	RBW: 10 kHz														
	VBW: 100 Hz														
2	Set 100 kHz at the MN1602A, MS2601A, and MG649A.														
3	Turn the MN1602A [CAL SIG] key on and read the level on the MS2601A.														
4	Turn the MN1602A [CAL SIG] key off, change the MG649A output level and read the MG649A level when the same reading is indicated as in step 3. Check that the level is 30 dB $\mu$ V $\pm$ 1.4 dB.														
5	Repeat steps 2 through 4 for the frequencies (up to 1000 MHz) shown in Table 5-3.														

---

APPENDIX 1  
ERROR MESSAGES

The MN1602A displays the error messages shown below.

When a setting is made that exceeds the following ranges

(1) through (3), an alarm sounds.

(1) Frequency range

(a) START FREQ

0 kHz to 2200 MHz,

$\text{START FREQ} + \text{SPAN FREQ} \leq 2200 \text{ MHz}$

(b) SPAN FREQ

0 to 2000 MHz,  $\text{START FREQ} \leq 0 \text{ kHz to } 2200 \text{ MHz} \leq$   
STOP FREQ

(c) CENTER FREQ

$\text{START FREQ} \leq 0 \text{ kHz to } 2200 \text{ MHz} \leq \text{STOP FREQ}$

(2) RF ATT range

0 to 65 dB

(3) CONTROL DATA range

1 to 16

(4) GP-IB command

When a command other than the MN1602A setting commands is sent to the MN1602A, the command is ignored. An alarm does not sound.

(5) X INPUT and Z INPUT connection

When the X INPUT and Z INPUT signals are not connected, the display "EE01" blinks.

(6) Key entry during scanning

When a DATA [UP or DOWN] key is pressed during scanning, an alarm sounds.

(7) Key entry at BYPASS

When the FREQ and INPUT ATTEN [UP and DOWN] keys are pressed at BYPASS, an alarm sounds.

(8) Key entry with CAL SIG ON

When the [INPUT ATTEN] key is pressed with CAL SIG ON, an alarm sounds.

## APPENDIX 2

### EXAMPLE OF CAL1 BASIC PROGRAM WITH GP-IB

```

100 !=====
110 !
120 !   MN1602A CAL1 PROGRAM
130 !
140 !   FILE NAME "CAL1"
150 !
160 !
170 !=====
180 !
190 LET PREAD=105!-----PRESEL ADDRES
200 LET SPEAD=101!-----SPEANA ADDRES
210 WRITE @SPEAD:"CAL 1"!-----FREQCAL
220 WRITE @SPEAD:"STF 30.000MZ"
230 WRITE @SPEAD:"SFF 0.2MZ"
240 WRITE @SPEAD:"ATT 0"
250 WRITE @SPEAD:"UNT 0"
260 WRITE @SPEAD:"RLV -40.0"
270 WRITE @SPEAD:"RBW 3"!-----RESBW=1KHZ
280 WRITE @SPEAD:"VBW 2"!-----VIDBW=100HZ
290 !
300 WRITE @SPEAD:"SWT 7000"!-----SWEEP TIME 7 SEC
310 !*****
320 !*****
330 !*****
340 STATUS @PREAD:STS!-----STATUS CHECK
350 WRITE @PREAD:"C1"!-----PRESEL CAL START
360 DO
370 STATUS @PREAD:STS!-----STATUS CHECK
380 EXIT IF (BIT(3,STS)=1 OR BIT(5,STS)=1) AND BIT(6,STS)=1 OR BIT(4,STS)=0 AND
D BIT(6,STS)=1
390 LOOP
400 DISP "*****CAL 1 END*****"
410 LCL @SPEAD
420 LCL @PREAD
430 END

```

### APPENDIX 3

#### EXAMPLE OF CAL2 BASIC PROGRAM WITH GP-IB

```

100 !=====
110 !
120 !   MN1602A CAL2 PROGRAM
130 !
140 !   FILE NAME "CAL2"
150 !
160 !=====
170 CLEAR
180 DIM INT I!                counter
190 DIM CALD(130)!           calibration frequency point
200 DIM DSP$*60!            display title data
210 DIM SP$*40!             display space data
220 !
230 MAT READ CALD!          calibration point freq. data read
240 LET PCNT=130!          calibration point count
250 LET SPADR=101!         MS2601A spectrum analyzer GP-IB adress
260 LET FRADR=105!        MN1602A preselector GP-IB adress
270 LET DSP$="*****   MN1602A CAL2 Program   *****"
280 LET SP$=""
290 !
300 CLEAR
310 SET DISPLAY 63,"1,4"!    CRT scroll area set
320 SET DISPLAY 16,"10,2"!  title print
330 PRINT DSP$
340 !
350 ENABLE HANDLER ERR
360 DCL @FRADR!             MN1602A device clear
370 !
380 WRITE @SPADR:"UNT 0"!-----UNIT DBm
390 WRITE @SPADR:"CAL 1"!-----FREQ CAL
400 FOR I=1 TO PCNT
410 !           calibration point freq. display
420 SET DISPLAY 16,"20,10"
430 PRINT "Calibration Point =";CALD(I);
440 PRINT "MHz"
450 !
460 WRITE @SPADR:"RLV -15.0"!-----REF -15DBm
470 WRITE @SPADR:"ATT 0"!-----ATT ODB
480 WRITE @SPADR:"RLV -15.0"
490 WRITE @SPADR:"ATT 0"!-----ATT ODB
500 WRITE @SPADR:"CNF "&STR$(CALD(I))&"MZ"!  center freq. set
510 IF CALD(I)=.499 THEN
520 WRITE @SPADR:"CNF 0.5MZ"
530 END IF
540 IF CALD(I)=1.799 THEN
550 WRITE @SPADR:"CNF 1.80MZ"
560 END IF
570 IF CALD(I)=3.699 THEN
580 WRITE @SPADR:"CNF 3.700MZ"
590 END IF
600 IF CALD(I)=6.999 THEN
610 WRITE @SPADR:"CNF 7.000MZ"
620 END IF
630 IF CALD(I)=11.999 THEN
640 WRITE @SPADR:"CNF 12.00MZ"
650 END IF

```

```

660 WRITE @SPADR:"SPF 0"&"KZ"!           span freq. 0kHz set
670 WRITE @SPADR:"AAT 0"!           attenuator manual mode
680 WRITE @SPADR:"ATT 0"!           attenuator 0dB set
690 WRITE @SPADR:"ARB 0"!           res. bw manual mode set
700 WRITE @SPADR:"VBW 2"!           vid. bw auto mode set
710 WRITE @SPADR:"SRQ 0"!           srq mode off
720 IF CALD(I)>=1.15 AND CALD(I)<1.6 THEN
730 WRITE @SPADR:"RBW 4"!           [0.15-1.6MHz] res. bw 3kHz set
740 ELSE
750 IF CALD(I)>=1.6 AND CALD(I)<90 THEN
760 WRITE @SPADR:"RBW 4"!           [1.6-90MHz] res. bw 3kHz set
770 ELSE
780 WRITE @SPADR:"RBW 5"!           [90-1000MHz] res. bw 10kHz set
790 END IF
800 END IF
810 WRITE @SPADR:"AST 0"!           sweep time manual mode set
820 WRITE @SPADR:"SWT 100000"!       sweep time 100 sec set
830 IF I=1 THEN
840 WRITE @PRADR:"SPOMZ"!           span freq. 0 Hz set
850 END IF
860 WRITE @PRADR:"CN"&STR$(CALD(I))&"MZ"! center freq.set
870 IF I=1 THEN
880 WRITE @PRADR:"AO"!           rf att 0db set
890 END IF
900 IF I=1 THEN
910 WAIT DELAY .5
920 END IF
930 WAIT DELAY .1
940 STATUS @PRADR:A
950 WRITE @PRADR:"C2"!           'c2' calibration start
960 DO
970 STATUS @PRADR:STS!           status check
980 PRINT BIT(3,STS);BIT(4,STS);BIT(5,STS);BIT(6,STS)
990 EXIT IF (BIT(3,STS)=1 OR BIT(5,STS)=1) AND BIT(6,STS)=1 OR BIT(4,STS)=0 AN
D BIT(6,STS)=1
1000 LOOP!           ;           ;           ;
1010 IF BIT(3,STS)=1 AND BIT(6,STS)=1 THEN
1020 LET ERR=1
1030 EXIT IF 1
1040 END IF
1050 NEXT I
1060 !
1070 WRITE @PRADR:"CE"!           calibration end
1080 !
1090 DISABLE HANDLER
1100 IF ERR=0 THEN
1110 DISP "*** Normal End ***"
1120 ELSE
1130 DISP "*** CAL2 ERROR *****"
1140 END IF

```

```

1150 !
1160 !=====
1170 !           calibration data point freq.
1180 !=====
1190 !
1200 DATA 0!           (freq. (MHz))           : 0
1210 DATA 0.15! [0.15-0.5] 0.15
1220 DATA 0.2!
1230 DATA 0.25!
1240 DATA 0.3!
1250 DATA 0.35!           : 5
1260 DATA 0.4!
1270 DATA 0.45!
1280 DATA 0.499!
1290 DATA 0.5!           [0.5-1.8]
1300 DATA 0.6!           : 10
1310 DATA 0.7!
1320 DATA 0.8!
1330 DATA 0.9!
1340 DATA 1.0!
1350 DATA 1.1!           : 15
1360 DATA 1.2!
1370 DATA 1.3!
1380 DATA 1.4!
1390 DATA 1.6!
1400 DATA 1.799!           : 20
1410 DATA 1.8!           [1.8-3.7]
1420 DATA 1.9!
1430 DATA 2.0!
1440 DATA 2.1!
1450 DATA 2.2!           : 25
1460 DATA 2.4!
1470 DATA 2.6!
1480 DATA 2.8!
1490 DATA 3.0!
1500 DATA 3.2!           : 30
1510 DATA 3.4!
1520 DATA 3.6!
1530 DATA 3.699!
1540 DATA 3.7!           [3.7-7.0]
1550 DATA 4.0!           : 35
1560 DATA 4.5!
1570 DATA 5.0!
1580 DATA 5.5!
1590 DATA 6.0!           : 40
1600 DATA 6.5!
1610 DATA 6.999!
1620 DATA 7.0!           [7-12]
1630 DATA 7.5!
1640 DATA 8.0!           : 45
1650 DATA 8.5!
1660 DATA 9.0!
1670 DATA 9.5!
1680 DATA 10.0!
1690 DATA 10.5!
1700 DATA 11.0!           : 50
1710 DATA 11.5!
1720 DATA 11.999!

```



1730	DATA	12.0!	[12-19]	
1740	DATA	12.5!		
1750	DATA	13!		:55
1760	DATA	14!		
1770	DATA	15!		
1780	DATA	16!		
1790	DATA	17!		
1800	DATA	18!		:60
1810	DATA	18.95!		
1820	DATA	19!	[19-30]	
1830	DATA	19.5!		
1840	DATA	20!		
1850	DATA	20.5!		:65
1860	DATA	21!		
1870	DATA	21.5!		
1880	DATA	22!		
1890	DATA	22.5!		
1900	DATA	23!		:70
1910	DATA	23.5!		
1920	DATA	24.05!		
1930	DATA	24.5!		
1940	DATA	25!		
1950	DATA	26!		:75
1960	DATA	27!		
1970	DATA	28!		
1980	DATA	29!		
1990	DATA	29.95!		
2000	DATA	30!	[30-50]	:80
2010	DATA	34!		
2020	DATA	38!		
2030	DATA	42!		
2040	DATA	46!		
2050	DATA	48!		:85
2060	DATA	49.8!		
2070	DATA	50!	[50-90]	
2080	DATA	55!		
2090	DATA	60!		
2100	DATA	65!		:90
2110	DATA	70!		
2120	DATA	75!		
2130	DATA	80!		
2140	DATA	85!		
2150	DATA	89.8!		:95
2160	DATA	90!	[90-160]	
2170	DATA	100!		
2180	DATA	110!		
2190	DATA	120!		
2200	DATA	128!		:100
2210	DATA	136!		
2220	DATA	144!		
2230	DATA	152!		
2240	DATA	159.8!		
2250	DATA	160!	[160-300]	:105
2260	DATA	170!		
2270	DATA	180!		
2280	DATA	190!		
2290	DATA	200!		

```

2300 DATA 210! :110
2310 DATA 220!
2320 DATA 230!
2330 DATA 240!
2340 DATA 250!
2350 DATA 260! :115
2360 DATA 267!
2370 DATA 274!
2380 DATA 281!
2390 DATA 288!
2400 DATA 294! :120
2410 DATA 299.8!
2420 DATA 300! [300-400]
2430 DATA 320!
2440 DATA 340!
2450 DATA 360! :125
2460 DATA 380!
2470 DATA 390!
2480 DATA 399.8! :128
2490 DATA 400.0! [400-1000]
2500 DATA 999.8! :130
2510 !
2520 HANDLER ERR
2530 BEEP 2000,200*WAIT DELAY .3*BEEP 2000,200*WAIT DELAY .3
2540 SET DISPLAY 16,"0,0"
2550 PRINT "EXTYPE = ";EXTYPE;" : EXLINE = ";EXLINE
2560 DO
2570 LINE ENTER PROMPT "<<< Error >>> Set OK? (Y) OR (N) [RETURN] key":IN$
2580 EXIT IF IN$="Y" OR IN$="N"
2590 DISP "<<< Format Error >>>"
2600 BEEP 2000,200*WAIT DELAY .3*BEEP 2000,200*WAIT DELAY .3
2610 LOOP
2620 IF IN$="Y" THEN
2630 PRINT SP$
2640 RETRY
2650 ELSE
2660 DISP "*** Abnormal End ***"
2670 STOP
2680 END IF
2690 END HANDLER
2700 END

```

## APPENDIX 4

### MN1602A SET PROGRAM LIST

```

100 !*****
110 !* MN1602A SET DATA USING FOR GP-IB *
120 !*****
130 !
140 START: !
150 LET PRISELE=105
160 LET SPANA=101
170 CLEAR
180 ENTER PROMPT "START FREQ OR CENTER FREQ? START/CENTER=0/1":SEL
190 IF SEL=0 THEN
200 ENTER PROMPT "START FREQ[MHZ]":STF
210 ELSE
220 ENTER PROMPT "CENTER FREQ[MHZ]":CNTF
230 END IF
240 ENTER PROMPT "SPAN FREQ[MHZ]":SPF
250 !
260 WRITE @PRISELE:"S0"
270 IF SEL=0 THEN
280 WRITE @PRISELE:"ST"&STR$(STF)&"MZ"
290 WRITE @SPANA:"STF "&STR$(STF)&"MZ"
300 ELSE
310 WRITE @PRISELE:"CN"&STR$(CNTF)&"MZ"
320 WRITE @SPANA:"CNF "&STR$(CNTF)&"MZ"
330 END IF
340 WRITE @PRISELE:"SF"&STR$(SPF)&"MZ"
350 WRITE @SPANA:"SPF "&STR$(SPF)&"MZ"
360 WRITE @PRISELE:"S1"
370 !
380 ENTER PROMPT "SET DATA AGAIN?--->YES(INPUT [1])":AA
390 IF AA=1 THEN GO TO START
400 END

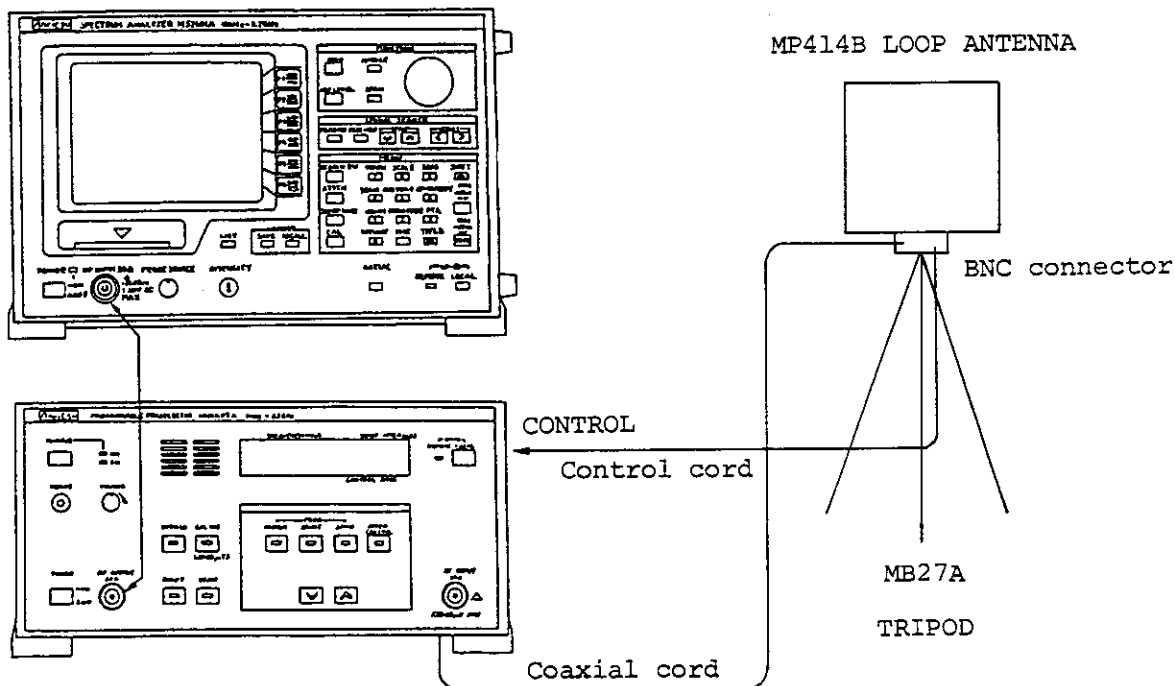
```

## APPENDIX 5

### CONTROLLING THE MP414B LOOP ANTENNA AND MP415B ROD ANTENNA

The MP414B or MP415B can be controlled via the MN1602A, by connecting the CONTROL connector on the MN1602A rear panel to the MP414B or MP415B with the control cord (which is supplied with the antenna as a standard accessory). By sending CONTROL DATA from the MN1602A to the MP414B or MP415B, the 9 k to 30 MHz electrical field strength can be measured by frequency sweeping. The connection and data setups are shown below.

#### (1) Method of Connection



APPENDIX 6

BYPASS CIRCUIT LOSS CHARACTERISTICS

Figure 6-1 shows an example of the BYPASS circuit loss characteristics.

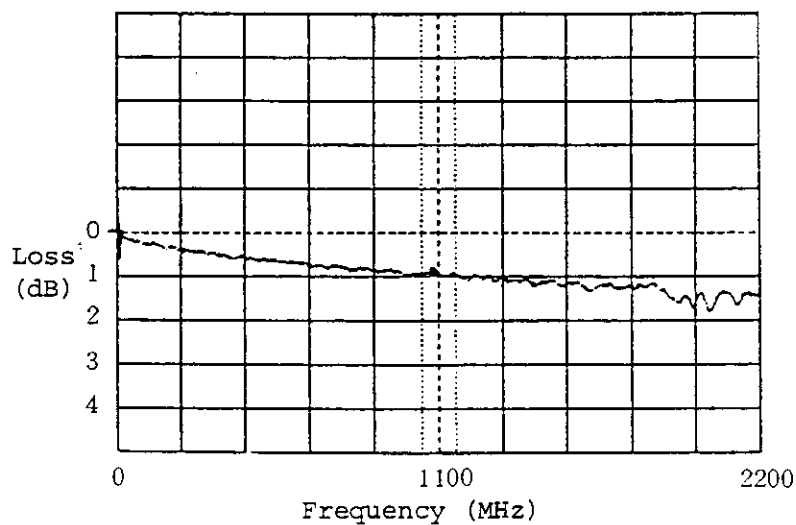


Fig. 6-1 BYPASS Circuit Loss Characteristics Example



# Anritsu Service and Sales offices

## America

### Anritsu Company (ACUS)

685-A Jarvis Drive Morgan Hill, CA  
95037-2809, U.S.A.  
Phone: +1-408-776-8300  
Fax: +1-408-776-1738

### Anritsu Company (ACUS-NJ) Dist.5

10 New Maple Avenue, P.O. Box 836  
Pine Brook, NJ 07058-0836, U.S.A.  
Phone: +1-973-227-8999  
Fax: +1-973-575-0092

### Anritsu Company (ACUS-Maryland) Dist.6

19630 Club House Road, #710  
Gaithersburg, MD20879, U.S.A.  
Phone: +1-301-590-0300  
Fax: +1-301-216-2893

### Anritsu Company (ACUS-Tx) NARO

1155 East Collins Blvd  
Richardson, TX 75081, U.S.A.  
Phone: +1-972-644-1777  
Fax: +1-972-644-3416

### Anritsu Electronics Ltd (ACCA)

5A-245 Matheson Blvd. East, Mississauga,  
Ontario, L4Z 3C9, Canada  
Phone: +1-905-890-7799  
Fax: +1-905-890-2290

### Anritsu Electronics Ltd (ACCA)

Unit 102, 215 Stafford Road West Nepean,  
Ontario, K2H 9C1, Canada  
Phone: +1-613-828-4090  
Fax: +1-613-828-5400

### Anritsu Electronics Ltd (ACCA)

Unit 200, 1405 Trans Canada Highway  
Dorval, Quebec H9P 2V9, Canada  
Phone: +1-514-421-3737  
Fax: +1-514-685-9839

### Anritsu Electronics Ltd (ACCA-Calgary)

Deerfoot Atrium, Suite 129, 6715-8th Street  
N.E., Calgary, AB, T2E 7H7, Canada  
Phone: +1-403-275-9855  
Fax: +1-403-275-3609

### Anritsu Eletrônica Ltd (ACBR)

Praia de Botafogo, 440-Sala 2401  
CEP 22250-040, Rio de Janeiro, RJ, Brazil  
Phone: +55-21-5276922  
Fax: +55-21-537-1456

### Anritsu Eletrônica Ltd (ACBR) Sao Paulo Branch Office

Praca Amadeu Amaral  
27-10 Andar, Conj. 101/102  
CEP 01327-010, Sao Paulo-SP, Brazil  
Phone: +55-11-283-2511  
Fax: +55-11-288-6940

### Data Lab S.R.L

Edif. Ayfra, Pdte. Franco y Ayolas  
Asuncion, Paraguay  
Phone: +595-21-443-046  
Fax: +595-21-441+935

### Electro-Impex S.A.

P.O. Box 620-1000, San Jose, Costa Rica  
Phone: +506-2-31-5701  
Fax: +506-2-31-6531

### Electronica 2000, S.A. DE C.V.

Blvd. Adolfo Lopez Mateos No.2016, Col.  
Tlacopac, Del. Lopez Mateos, 01010,  
Mexico D.F.  
Phone: +525-662-8800  
Fax: +525-662-5862

### Electronic Engineering S.A.

Carretera de Circunvalacion, Sabanilla, Av  
Novena, San Jose, Costa Rica  
Phone: +506-2-25-8793  
Fax: +506-2-25-1286

### HDM Elquitecnica Cia. Ltda., Equitronics S.A.

Av. Republica de El Salvador, No.880,  
Edificio, Almirante Colon 4to piso,  
Quito, Ecuador  
Phone: +593-9-704890  
Fax: +593-2-48-2627

### KRM Ingenieria Saciafs.

Viamonte 377,7° Piso 1053 Buenos Aires,  
Argentina  
Phone: +54-1-311-4165  
Fax: +54-1-311-2297

### SI Ltda.

E. Conchy Y Toro 65, Casilla 51888,  
Santiago, Chile  
Phone: +56-2-696-7534  
Fax: +56-2-696-9665

### Radiocom S.A.

Carrera 21 No.85-71, Conmutador  
6100077, Santafe de Bogota, Columbia  
Phone: +57-1-218-2054  
Fax: +57-1-610-3272

### Radiocomunicaciones cruz C.A.

Avda La Colina QTA. Elison, URB Colina  
De Los Caobos, Caracas, Venezuela  
Phone: +58-2-793-2322  
Fax: +58-2-793-3429

### Sakata Ingenieros S.A.

Av. Canavai Moreyra 840, Lima 27, Peru  
Phone: +51-1225-7555  
Fax: +51-1224-8148

### Suministros Industriales S.A.

Casa 102, Calle 68 Este,  
San Francisco, Balboa, Panama  
Phone: +507-270-2328  
Fax: +507-270-2329

### Cabonorte S.A.

Colonia 1900, ESC. 603,  
Montevideo, Uruguay  
Phone: +598-2-430522  
Fax: +598-2-418594

## Europe

### Anritsu Ltd (ACUK)

200 Capability Green, Luton  
Bedfordshire, LU1 3LU, United Kingdom  
Phone: +44-1582-433200  
Fax: +44-1582-731303

### Anritsu Ltd (ACUK-Manchester)

Kansas Avenue, Langworthy Park Salford,  
Manchester M5 2GL, United Kingdom  
Phone: +44-161-873-8041  
Fax: +44-161-873-8040

### Anritsu Ltd (ACUK-Bristol)

1230 Aztec West, Almondsbury  
Bristol BS12 4SG, United Kingdom  
Phone: +44-1454-615252  
Fax: +44-1454-618017

### Anritsu Ltd (ACUK-Livingston)

Unit 1, Knightsridge Industrial Estate  
Turnbull Way, Knightsridge Livingston  
EH54 8RB, United Kingdom  
Phone: +44-1506-436111  
Fax: +44-1506-436112

### Anritsu GmbH (ACDE)

Grafenberger Allee 54-56  
D-40237 Düsseldorf 1, Germany  
Phone: +49-211-96855-0  
Fax: +49-211-96855-55

### Anritsu GmbH (ACDE-Sales Center South)

An der Steinernen Brücke 1 D-85757  
Karlsfeld, Germany  
Phone: +49-8131-38250  
Fax: +49-8131-382595

**Anritsu S.A. (ACFR)**

9, avenue du Québec ZA de  
Courtaboeuf 91951 Les Ulis Cedex,  
France  
Phone: +33-1-60-92-15-50  
Fax: +33-1-64-46-10-65

**Anritsu S.A. (ACFR)  
(Toulouse Office)**

Bureau de Toulouse  
Région Centre Sud Ouest  
Phone: +33-5-62070484  
Fax: +33-5-62070668

**Anritsu S.A. (ACFR)  
(Toulon Office)**

Bureau de Toulon  
Région Centre Sude Est  
Phone: +33-4-94040264  
Fax: +33-4-94040265

**Anritsu S.A. (ACFR)  
(Rennes Office)**

Bureau de Rennes  
Région Ouest  
Phone: +33-2-99521214  
Fax: +33-2-99521224

**Anritsu S.p.A. (ACIT)**

Via Elio Vittorini, 129  
00144 Roma EUR, Italy  
Phone: +390-6-502-2666  
Fax: +390-6-502-2425

**Anritsu S.p.A (ACIT-Milano)**

C.D. Colleoni, Via Paracelso, 420041  
AGRATE B.ZA(MI), Italy  
Phone: +390-39-605-7813  
Fax: +390-39-605-6396

**Anritsu AB (ACSE)**

BOTVID CENTER  
145 84 STOCKHOLM, Sweden  
Phone: +46-8-53470700  
Fax: +46-8-53470730

**Anritsu AB-Norway Branch  
Office (ACNO)**

Øvre Måsan 10C 1370 Asker, Norway  
Phone: +47-66-901190  
Fax: +47-66-901212

**Anritsu AB-Finland Branch  
Office (ACFI)**

Kappelitie 8 02200 Espoo, Finland  
Phone: +358-9-435-5220  
Fax: +358-9-435-522-50

**Anritsu AB-Denmark Branch  
Office (ACDK)**

SOHOJ 11, DK-2690 KARLSLUNDE  
Denmark  
Phone: +45-46155199  
Fax: +45-46155299

**C.N. Rood B.V.**

Cort van der Linddenstraat 11-13, 2288  
EV Rijswijk ZH, The Netherlands  
Phone: +31-70-3996360  
Fax: +31-70-3905740

**C.N. Rood SA/NV**

Pontbeeklaan 45, 1731 Zellik, Belgium  
Phone: +32-2-4668199  
Fax: +32-2-4662500

**ELSINCO GMBH**

h.e. Strelbishte, str. Kottlenki Prohod, bl.  
96/6/14, BG-1408 Sofia, Bulgaria  
Phone: +359-2-58-61-31  
Fax: +359-2-58-16-98

**ELSINCO Praha Spol.**

Novedvorska 994, CZ 142 21 Praha  
4-Branik, Czecho Republic  
Phone: +42-2-49-66-89  
Fax: +42-2-49-54-83

**ELSINCO Budapest KFT**

Pannonia utca 8. IV/l.  
H-1136 Budapest, Hungary  
Phone: +36-1-269-18-50  
Fax: +36-1-132-69-27

**ELSINCO Polska Sp. Z.O.O**

ul. Dziennikarska 6/1, PL 01 605  
Warszawa, Poland  
Phone: +48-22-39-69-79  
Fax: +48-22-39-44-42

**ELSINCO Bratislava Spol. s.r.o.**

Kudlakova 4, SK 844 15 Bratislava,  
Slovakia  
Phone: +42-7-784-165  
Fax: +42-7-784-454

**G'Amungason Co.**

Skulagata 40, 101 Reykjavik, Iceland  
Phone: +354-1-677887  
Fax: +354-1-625045

**GMP S.A.**

Av. des Baumettes 19, CH-1020 Renens  
1 Lausanne, Switzerland  
Phone: +41-21-6348181  
Fax: +41-21-6353295

**Instrutek Oeriferi A/S**

Christiansholmsgade DK-8700 Horsens,  
Denmark  
Phone: +45-75-611100  
Fax: +45-75-615658

**Kostas Karayannis SA**

58, Kapodistriou str., GR-142 35 Nea Ionia,  
Athens, Greece  
Phone: +30-1-680-0460-4  
Fax: +30-1-685-3522

**Omnitecnica S.A.**

Estrada Alfragide 2700 Amadora, Portugal  
Phone: +351-1-471-55-17  
Fax: +351-1-471-36-10

**Pema Ltd.**

Doromiskin, Dundalk, Co. Louth, Ireland  
Phone: +353-42-72899  
Fax: +353-42-72376

**Unitronics S.A.**

Plaza Espana 18, Torre de Madrid,  
Pl. 12-ofc. 9, 28019 Madrid, Spain  
Phone: +34-1-5425204  
Fax: +34-1-5591957

**Wien CHALL GMBH**

Krichbaumgasse 25, 1120 Wien, Austria  
Phone: +43-1-811-55140  
Fax: +43-1-811-55180

**Asia, Pacific  
and Africa**

**Anritsu Private Ltd (ACSG)**

6, New Industrial Rd., #06-01/02  
Hoe Huat Industrial Building  
Singapore 536199  
Phone: 65-282-2400  
Fax: 65-282-2533

**Anritsu Company Ltd (ACHK)**

Suite 812, 8/F., Chinachem Golden Plaza,  
77 Mody Road, Tsimshatsui  
East, Kowloon, Hong Kong  
Phone: +852-2301-4980  
Fax: +852-2301-3545

**Anritsu Company Incorporated  
(ACTW)**

96, Sec. 3, Chien Kou North Rd.  
Taipei, Taiwan  
Phone: +886-2-2515-6050  
Fax: +886-2-2509-5519

**Anritsu Corporation, Ltd (ACKR)  
Head Office**

Room No. 901 Daio Bldg, 26-5,  
Yeoido-dong, Youngdeungpo-ku  
Seoul, Korea  
Phone: +82-2-782-7151-6  
Fax: +82-2-782-4590

**Anritsu Corporation, Ltd (ACKR)  
Taegu Branch Office**

Room No. 1004 Samkwang Bldg, 317-7,  
Shincheon 4 Dong, Dong-Ku, Taegu, Korea  
Phone: +82-53-745-6061  
Fax: +82-53-745-6062



**Anritsu Proprietary Ltd (ACAU)**

Unit 3, 170, Forster Rd., Mt. Waverley  
Victoria 3149, Australia  
Phone: +61-3-9558-8177  
Fax: +61-3-9558-8255

**Anritsu Proprietary Ltd (ACAU)**

Suite 304/2 Rowe Street Eastwood  
NSW 2122, Australia  
Phone: +61-2-9874-9044  
Fax: +61-2-9874-9920

**Anritsu Corporation  
Beijing Liaison Office**

Room No.1515, Beijing Fortune Bldg. 5  
Dong-San-Huan-Bei-Lu Chao-Yang  
District Beijing 100004, P.R. China  
Phone: +86-10-6590-9230-9234  
Fax: +86-10-6590-9235

**Anritsu Corporation  
Shanghai Liaison Office**

No.511 Shanghai Jing Tai Building  
No.58, Mao Ming Nan Rd. Sanghai  
200020 P.R. China  
Phone: +86-21-6415-5137  
Fax: +86-21-6472-6677

**Anritsu Corporation  
New Delhi Liaison Office**

Room No. 508, Prakash Deep,  
7 Tolstoy Marg, New Delhi-110001, India  
Phone: +91-11-331-9133  
Fax: +91-11-371-3948

**Associated Electric Trading  
Corp.**

Zia Chambers, 25 McLeod Rd., Lahore,  
Pakistan  
Phone: +92-42-722-1716  
Fax: +92-42-7221456

**Chris Radiovision Ltd.**

Kouloumbri Building, 23 Crete Street,  
P.O. Box 1989, Nicosia, Cyprus  
Phone: +357-2-466121  
Fax: +357-2-365177

**Electronic Equipment  
Marketing Co.**

P.O. Box 3750, Riyadh 11481,  
Saudi Arabia  
Phone: +966-1-4771650  
Fax: +966-1-4785140

**Etecta (Pty) Ltd.**

1st Floor Montrose Place, Waterfall Park,  
Bekker Rd., Midrand, South Africa  
Phone: +27-11-315-1366  
Fax: +27-11-315-2175

**Giza Systems Engineering**

2 El Mesaha Square, Dokki A.R.E.,  
P.O.Box 1913, Cairo 11511, Egypt  
Phone: +20-2-349-0140  
Fax: +20-2-360-9932

**Infotechs Ltd.**

23-1, Jaya Rd., Colombo 4, Sri Lanka  
Phone: +94-1-580088  
Fax: +94-1-584644

**Inter Muhendislik Danismanlik  
ve Ticaret A.S.**

Farabi Sokak No: 24/14  
Cankaya-06680 Ankara, Turkey  
Phone: +90-312-4277792  
Fax: +90-312-4277937

**Jasmine Telecom  
Systems Co., Ltd.**

333 Laksi Plaza 6th Floor, Tower 2,  
Chaengwatana Rd., Donmuang, Bangkok  
10210, Thailand  
Phone: +66-2-576-0200  
Fax: +66-2-576-0420

**Meera Agencies (P) Ltd.**

A-23 Hauz Khas New Delhi 110 016, India  
Phone: +91-11-685-3959  
Fax: +91-11-685-2275

**UAE****Utmost Electronics Trading  
(L.L.C.)**

P.O. Box 41175 Abu Dhabi, U.A.E.  
Phone: +971-2-768909  
Fax: +971-2-768907

**Martwell Electronics Pvt., Ltd**

3rd Floor, Francis House, Stanley Avenue,  
P.O. Box 1737, Harare, Zimbabwe  
Phone: +263-4-793578  
Fax: +263-4-737956

**Mandeno Electronic Equip. Co.**

463 Mt. Eden Rd. Mt. Eden,  
Auckland 1003, New Zealand  
Phone: +64-9-630-7871  
Fax: +64-9-630-1720

**National Projects and  
Technology Co. L.L.C**

P.O. Box 97, Wadi Al Kabir, Postal Code 117,  
Sultanate of Oman  
Phone: +968-791704  
Fax: +968-791697

**O'Connors Engineering  
& Trading (Malaysia) Bhd**

3rd Floor, Wisma Siong Huat,  
Lot 13, Jalan 51A/223  
46100 Petaling Jaya,  
Selangor Darul Ehsan, Malaysia  
Phone: +60-3-757-2828  
Fax: +60-3-757-7871

**P.T. Subur Sakti Putera**

Jalan Musi No.32, Jakarta 10150,  
Indonesia  
Phone: +62-21-3803644  
Fax: +62-21-3845043

**Qatar Communications Ltd.**

P.O. Box 2481, Doha, Qatar  
Phone: +974-424347  
Fax: +974-324777

**Trading and Agency Services**

P.O. Box 1884, Doha, Qatar  
Phone: +974-432212  
Fax: +974-422255

**Rajab & Silsilah & Co.**

P.O. Box 203 Jeddah 21411, Saudi Arabia  
Phone: +966-2-6610006  
Fax: +966-2-6610558

**Salritsu International Trading  
Corporation**

50B ODC International Plaza  
Condominium, 219 Saicedo St., Legaspi  
Village, Makati, Metro Manila, Philippines  
Phone: +63-2-816-2646  
Fax: +63-2-815-0986

**Sedel**

24, 26, Bd, Resistance, Casablanca,  
Morocco  
Phone: +212-2-302444  
Fax: +212-2-449311

**Superior Electronics Associated**

B-98 Block H, North Nasimabad, Karachi-  
33, Pakistan  
Phone: +92-21-613655

**Tareq Company**

P.O. Box 20506 Safat, 13066 Safat, Kuwait  
Phone: +965-2336-100  
Fax: +965-2437-700

**Tech-Cent Ltd.**

Haarad St. No.7, Ramat Haahayal,  
Tel-Aviv 69710, Israel  
Phone: +972-3-6478563  
Fax: +972-3-6478334

**Test**

Sehit Adem Yavuz Sokak No.6/17,  
Kizilay-Ankara, Turkey  
Phone: +90-41-71086  
Fax: +90-41-74384

**Head Office**

5-10-27, Minamiazabu, Minato-ku,  
Tokyo 106-8570  
Phone: 03-3446-1111  
Fax: 03-3442-0235

**Atsugi Factory**

1800, Onna, Atsugi-si, Kanagawa 243-8555  
Phone: 0462-23-1111  
Fax: 0462-25-8379

