MICRONIX

3.3GHz/8.5GHz Spectrum Analyzer

MSA438(E/TG)/MSA458

Operating manual

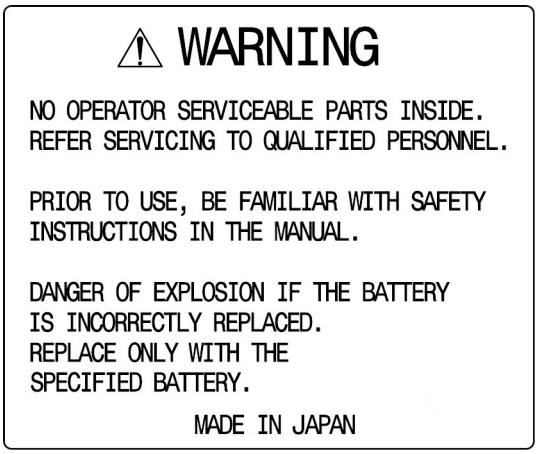
Ver.2.5 / Nov. / 2021

MICRONIX CORPORATION

OM-08022

Before Using the Product

· Please use following the below notes described on the back panel.



· For safe use

1) When abnormal sound, abnormal smell or smoke is found, stop using and remove the battery and AC adapter.

2) Never use this product by wet hands, or the electric shock, a fire or the damage is caused.

3) Never use this product when thundering, or the damage by lightning may be caused.

4) Never use any AC adapter other than specified, or the damage is caused. And connect the power cable to three-terminal outlet for protecting from static electricity, or this product or a device under test may be damaged.

5) Never use any battery other than specified, or this product is damaged. When removing or installing the battery, do it after turning off the power and disconnecting AC adapter.

6) Be sure to charge the battery by the specified way.
Moreover, an explosion, a fire or smoking may happen if the handling of the battery is improper.
Please read the notes of the handling of battery.

· Set clock function

The time information is set at Japan standard time. Set the year, month, day and time when MSA400 series is used for the first time. (Refer to "24.4 Setting of clock" for the details.)

· Quality assurance

Warranty

If the defect by our responsibility occurs within one year after delivered, it shall be repaired free of charge. However, this warranty does not cover such defect that :

1) is caused by a fire or natural disasters.
2) is caused by inappropriate handling such as dropping while moving the unit delivered.
3) is caused by handling in contradiction to usage or precautions described in the operating manual.
4) is caused by modification or misuse.

We will not be responsible for direct or indirect damage caused by use or defect of this product.

Warm-up time

Warm up the product for ten minutes at least after turning on the power in order to stabilize the internal circuit.

Precautions for storage

1) Store this unit avoiding direct sunlight or dust.
2) Store this unit in a place where temperature is -20°C to 60°C, humidity is less than 60°C/70%RH and also variation of temperature and humidity is small.

After service

Please contact us without hesitation if you have any questions about this product:

MICRONIX CORPORATION
2987-2, KOBIKI-CHO, HACHIOJI-SHI, TOKYO 193-0934 JAPAN
TEL. +81-42-637-3667 FAX. +81-42-637-0227
URL: http://www.micronix-jp.com/ E-mail: micronix_e@micronix-jp.com

Contents

1. Outline

1.1 Product outlines

MSA400 series is an authentic spectrum analyzer providing performance and functions that are comparable to those of large-size bench type equipment, in a compact, lightweight and inexpensive model.

The features are as follows.

1) Compact and lightweight 1.8kg

The dimensions are as small as 162(W)×71(H)×265(D)mm, and the weight is only 1.8kg including the battery. It is very convenient for outdoor use and on business trip.

2) Large and color TFT display

5.7 inches, 640×480 dots and color LCD

3) Four hours battery operation

Lithium-ion battery MB400 (option) fully charged enables about four-hour battery operation at minimum backlight brightness.

4) USB memory (A plug)

USB memory can be used as a removable storage. The screen image is stored by BMP format, and the spectrum and the setting parameters are stored by CSV format.

5) USB communication (B plug)

Such fast transfer rate as 12Mbps maximum was achieved by adoption of USB interface.

6) Accurate frequency measurement by PLL synthesizer

The center frequency is accurately set by PLL (Phase Locked Loop) synthesizer. Moreover, the frequency counter (factory option) enables to measure the frequency of the signal more accurately.

7) Average noise level -127dBm (MSA438(E/TG))

The low average noise level of -127dBm @ 1GHz provides a wide dynamic range.

8) 100dB display dynamic range

As the display scale in the amplitude axis is 100dB/10div (at 10dB/div), the signal is observed in a wide dynamic range.

9) Easy operation by AUTO mode

- By auto range operation, RBW, VBW and sweep time are automatically selected based on the frequency span.
- By auto tuning operation, the center frequency is adjusted to the maximum level within full span, and the optimum RBW, VBW and sweep time are chosen.

10)Competitive functions

- Measuring functions : Channel power, Adjacent channel power, Occupied bandwidth, Electric field strength, Magnetic field strength and Frequency measurement.
- Calculation functions : Max hold, Min hold, Averaging, Over write
- Marker measurement and peak search function
- Save/Load function
- Hard copy with printer

11)Abundant options

A lot of options such as PC software, Logging software, VSWR bridge, Dipole antenna, Magnetic field probe, USB printer, Frequency counter, Lithium-ion battery and Test accessories are available.

1.2 Standard accessories

1. AC adaptor MA400
2. Carrying case
3. Accessory pouch
4. Operating manual

1.3 Lineup of four models

Model	Contents
MSA438	50kHz to 3.3GHz The most popular model Applications: Cellular phone, 2.4GHz wireless LAN, 2.5GHz WiMAX, RF-ID, Broadcasting
MSA458	50kHz to 8.5GHz Covering most of the wireless communication Applications: 5GHz wireless LAN, 3.5/5.8GHz WiMAX, ETC/DSRC, Maintenance of wireless base station
MSA438TG	50kHz to 3.3GHz With 5MHz to 3.3GHz tracking generator Applications: Frequency characteristics measurement of electronic component/circuit and return loss measurement
MSA438E	50kHz to 3.3GHz For EMI test Applications: Radiated emission measurement and conducted emission measurement

2. Specifications

2.1 Performances

■ Frequency section

<table>
<tr><td colspan="2"></td><td>MSA438/438E/438TG</td><td colspan="3">MSA458</td></tr>
<tr><td colspan="2">Frequency range</td><td>50kHz to 3.3GHz</td><td colspan="3">50kHz to 8.5GHz</td></tr>
<tr><td colspan="2" rowspan="4"></td><td rowspan="4">——</td><td>Frequency range</td><td>Frequency band</td><td>Harmonic order</td></tr>
<tr><td>50k to 3.5GHz</td><td>Base band</td><td>1</td></tr>
<tr><td>3.3G to 6.3GHz</td><td>Band 1-</td><td>1</td></tr>
<tr><td>6.1G to 8.5GHz</td><td>Band 1+</td><td>1</td></tr>
<tr><td colspan="2">Center frequency</td><td colspan="4"></td></tr>
<tr><td rowspan="3"></td><td>Setting resolution</td><td colspan="4">20kHz
Allows rotary encoder, numeric key and function key</td></tr>
<tr><td>Accuracy</td><td>±(30+20T)kHz±1dot
@frequency span: 200kHz to 10MHz, RBW 3kHz, 23±5℃
±(60+300T)kHz±1dot
@frequency span: 20MHz to 3.3GHz, RBW 100kHz、23±5℃
T: sweep time (s)</td><td colspan="3">±(30+20T)kHz±1dot
@frequency span: 200kHz to 10MHz, RBW 3kHz, 23±5℃
±(60＋300T)kHz±1dot
@frequency span: 20MHz to 8.5GHz, RBW 100kHz, 23±5℃
T: sweep time (s)</td></tr>
<tr><td>RBW frequency error</td><td colspan="4">±4kHz @ 3kHz, 10kHz, 30kHz
RBW±20% @ RBW: 100kHz, 300kHz
RBW±10% @ RBW: 1MHz, 3MHz</td></tr>
<tr><td colspan="2">Frequency span</td><td colspan="4"></td></tr>
<tr><td rowspan="2"></td><td>Setting range</td><td>0Hz (zero span),
200kHz to 2GHz (1-2-5 step) and
3.3GHz (full span)</td><td colspan="3">0Hz (zero span),
200kHz to 5GHz (1-2-5 step) and
8.5GHz (full span)</td></tr>
<tr><td>Accuracy</td><td colspan="4">±3% ±1dot
@ one step slower sweep time than AUTO, 23±5℃</td></tr>
<tr><td colspan="2">Display dots</td><td colspan="4">501dots @ LCD screen, 1001dots @ USB communication
※1001 dots are captured in the unit.</td></tr>
<tr><td colspan="2">Resolution bandwidth</td><td colspan="4">3dB bandwidth (6dB for MSA438E@ 9kHz, 120kHz, 1MHz)</td></tr>
<tr><td rowspan="3"></td><td>Setting range</td><td colspan="4">3kHz to 3MHz (1-3 step) and AUTO
(MSA438E: 3kHz, 9kHz, 30kHz, 120kHz, 300kHz, 1MHz, 3MHz)</td></tr>
<tr><td>Accuracy</td><td colspan="4">±20%</td></tr>
<tr><td>Selectivity</td><td colspan="4">1 : 12 (typical, 3dB : 60dB)</td></tr>
<tr><td colspan="2">Video bandwidth</td><td colspan="4">100Hz to 1MHz (1-3 step) and AUTO</td></tr>
<tr><td colspan="2">SSB phase noise</td><td colspan="4">-90dBc/Hz (typical)
@100kHz offset, RBW : 3kHz, VBW : 100Hz, sweep time: 1s</td></tr>
<tr><td colspan="2">Spurious response</td><td colspan="4">less than -60dBc</td></tr>
<tr><td colspan="2">Harmonics</td><td colspan="4">less than -40dBc @ ≧100MHz</td></tr>
</table>

■ Amplitude section

		MSA438/438E/438TG	MSA458
Reference level			
	Setting range	+10 to -60dBm (1dB step)	
	Accuracy	±0.8dB ±1dot @CF : 100MHz, RBW : 3MHz, VBW : 1MHz, REF : -15dBm, 23±5℃	
	Unit	dBm, dBV, dBmV, dBμV, dBμV/m, dBμA/m (dBμV/m and dBμA/m are used in the measuring function)	
Average noise level		-127dBm (typical) @ CF : 1GHz, RBW : 3kHz, VBW : 100Hz	-123dBm (typical) @ CF : 1GHz, RBW : 3kHz, VBW : 100Hz
Frequency characteristics		±2.0dB ±1dot @50kHz to 100MHz ±1.0dB ±1dot @ 100MHz to 3.3GHz	±2.0dB ±1dot @50kHz to 100MHz ±1.0dB ±1dot @100MHz to 8.5GHz
Input impedance		50Ω	
Input VSWR		less than 2.0	
Input attenuator			
	Operating range	0 to 25dB (1dB step), coupled with reference level	
	Switching error	±0.6dB @100MHz	
RBW switching error		±0.6dB	
Display dots		381 dots/10div	
Display scale	**Scale**	10dB/div, 5dB/div, 2dB/div	
	Accuracy	±(0.2dB+1dot)/2dB ±(0.4dB+1dot)/5dB ±(0.8dB+1dot)/10dB ±(1.8dB+1dot)/83dB	
Input damage level		+27dBm(CW average power), 25VDC	

■ Sweep section

		MSA438/438E/438TG	MSA458
Sweep time			
	Setting range	10ms to 30s and AUTO @frequency span : 0 to 2GHz 30ms to 30s and AUTO @frequency span : full span ※1-3 step	10ms to 30s and AUTO @frequency span : 0 to 2GHz 30ms to 30s and AUTO @frequency span : 5GHz, full span ※1-3 step
	Accuracy	±0.1%±1dot @frequency span : 0 to 2GHz	±0.1%±1dot @frequency span : 0 to 5GHz
		±1.5%±1dot @ full span	±2.5%±1dot @ full span
Trigger			
	Trigger mode	AUTO (Available only for zero span)	
	Trigger source	Internal and External	

	External trigger	
	Input voltage range	1 to 10Vp-p
	Frequency range	DC to 5MHz
	Input coupling	DC coupling
	Trigger level	approx. 0.56V(fix)
	Input RC	approx. 10kΩ// less than 15pF
	Input damage level	±50V(DC+AC peak)
	Input connector	SMA(J)
Detection mode		Positive peak, Negative peak, Sample (As for MSA438E, QP and AV are added further.)

■ Function

		MSA438/438E/438TG/458 common
Marker measurement		NORM : displays frequency (8digits max) and level (4digits max) at marker point. DELTA : displays frequency difference and level difference between two markers.
Peak search function		Searches for peak level with all of 10 div (NORM mode) or within ZONE specified (ZONE mode) and displays frequency and level at peak level, and moreover NEXT peak at NORM mode.
Calculation function		NORM, MAX HOLD, MIN HOLD, AVERAGE, OVER WRITE Number of sweeps is 2 to 1024 (power of 2) and infinite.
Measuring function		Channel power, Adjacent channel power, Occupied bandwidth, Electric field strength (needs optional dipole antenna), Magnetic field strength (needs optional magnetic field probe) and Frequency counter (factory option)
Auto tuning		When pressing AUTO TUNE key, the spectrum of maximum level within full span is adjusted to center, and reference level, RBW, VBW and sweep time are set to optimum parameters.
Save/ Load	**Save**	Saves 200 spectrums and 200 setting parameters
	Load	Loads one spectrum and one setting parameter

■ General

		MSA438/438E/438TG/458 common
Input connector		N(J) connector
Communication		
	Interface	Corresponding to USB 2.0
	Connector	B plug (device)
	Transfer rate	Full speed (12Mbps)
Hard copy		USB printer (option) connected to A plug (host) enables hard copy of screen.
USB memory		Uses A plug (host), and stores spectrum data, setting parameters and spectrum data + setting parameters.
Display		
	Display	5.7 inches and color LCD
	Backlight	LED backlight
	Number of dots	640(H) x 480(V) dots
Power supply		
	Kind of power supply	External DC source (by dedicated AC adaptor MA400) and Lithium-ion battery (by optional MB400)

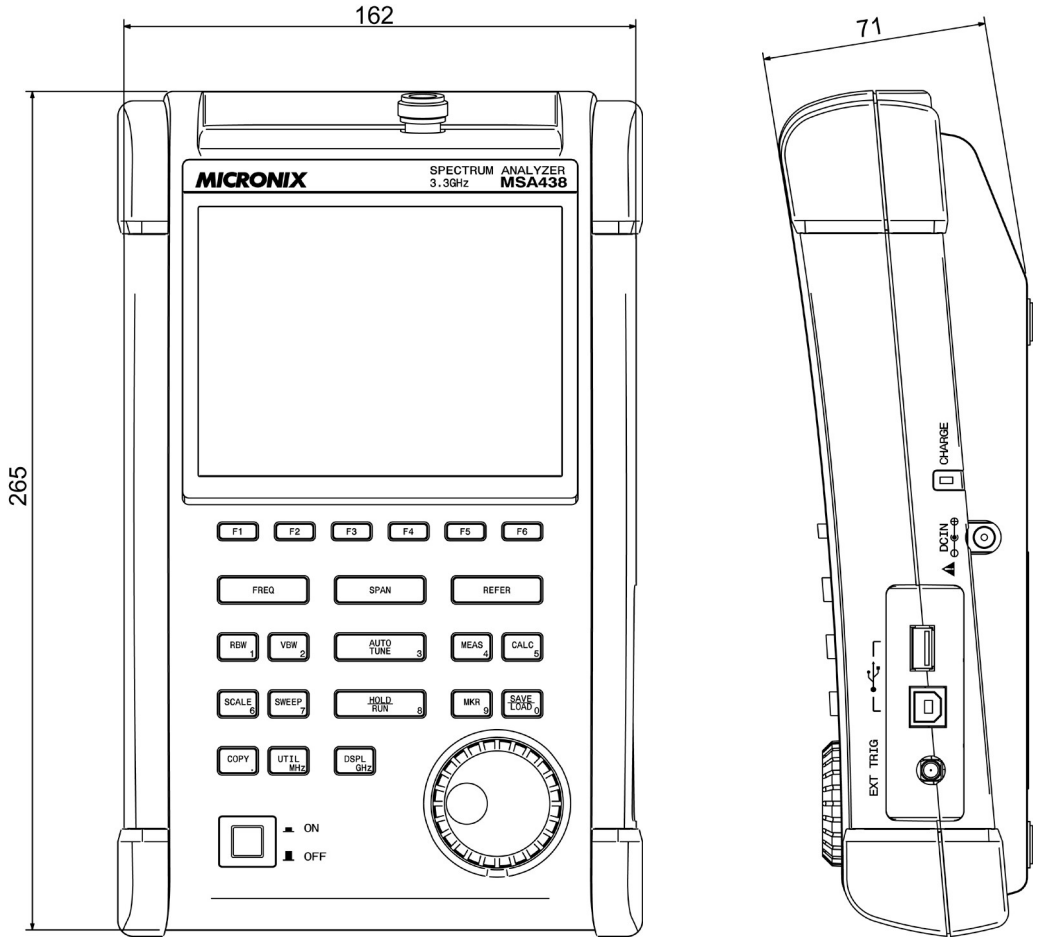
	Dedicated AC adaptor	Input : 100 to 240VAC Output : 9VDC/2.6A
	Lithium-ion battery	MB400 : 7.4V/5000mAh
	Charge function	Capable of charging during power-off. Indicates 4 conditions with two colors LED (red and green).
	Remainder indication	5 levels indication

■ Other

	MSA438/438E/438TG/458 common
Operating temperature	0 to 50°C (guaranteed at 23±10°C, without soft carrying case)
Operating humidity	less than 40°C/80%RH (guaranteed at less than 33°C/70%RH, without soft carrying case)
Storage temperature	-20 to 60°C, less than 60°C/70%RH
Dimensions	162(W) x 71(H) x 265(D)mm (excluding projections, protection bumper and stand)
Weight	approx. 1.8kg (including battery)

*** Refer to『22. Tracking Generator Mode』for the specifications of MSA438TG.**

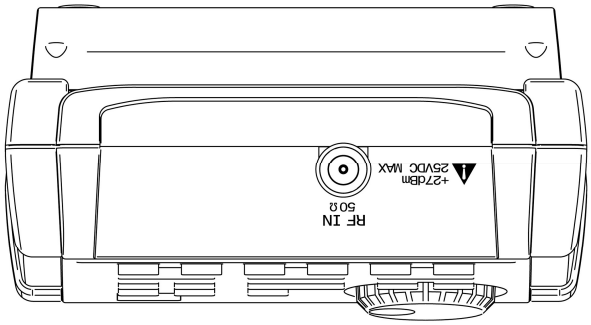
2.2 External view



[Unit : mm]

* MICRONIX Corporation reserves the right to make changes in design, specification and other information without prior notice.

3. Explanation of Panel



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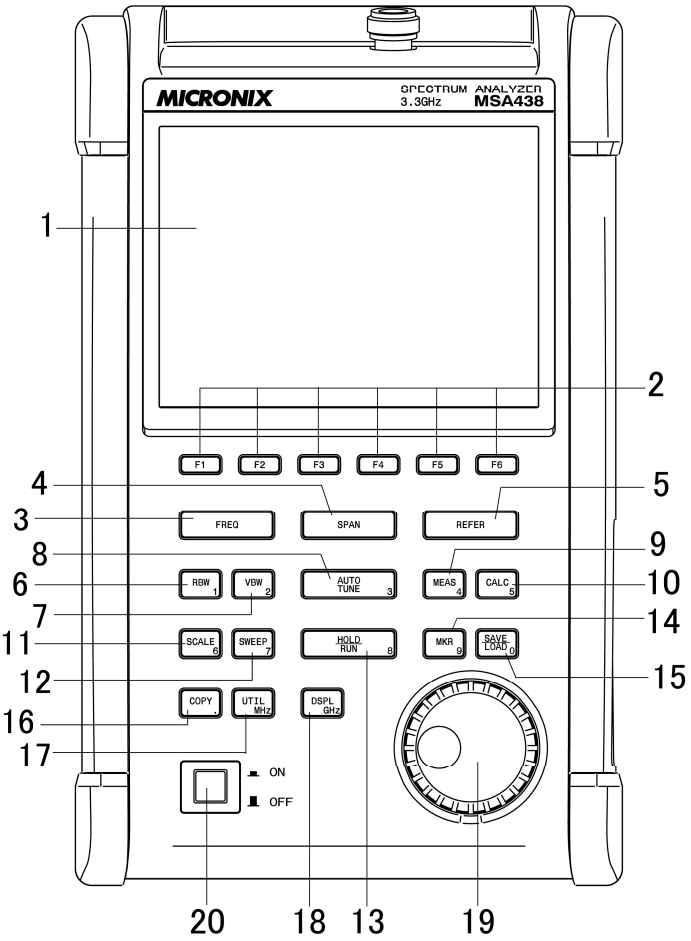
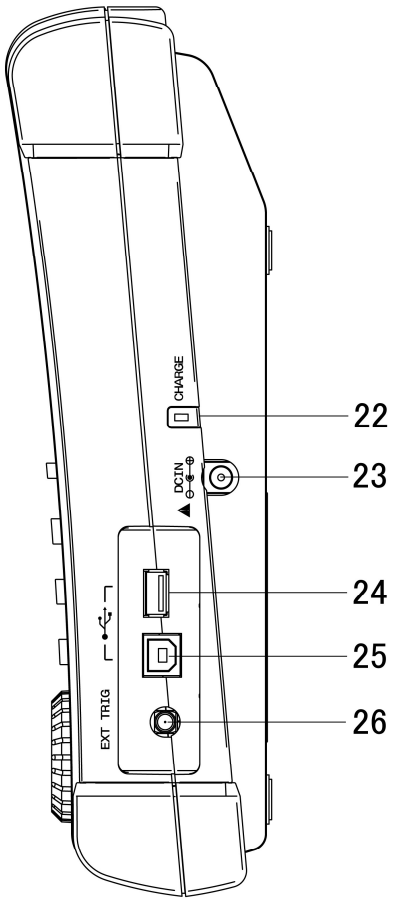




1) TFT display

This is a large liquid crystal display with 480 (V) × 640 (H) dots. It simultaneously displays spectrum (10div × 10div), various setting parameters, measured values and etc.

2) Function key (F1 to F6)

The function is changed according to the operation key.

3) Center frequency key

The center frequency is set with this key. The setting range is 0 to 3.3GHz(for MSA438, MSA438TG and MSA438E), and 0 to 8.5GHz(for MSA458). The setting resolution is 20kHz.

4) Frequency span key

The frequency span is set with this key.

For MSA438, MSA438TG and MSA438E, it is set in/to the range from 200kHz to 2GHz, ZERO SPAN or FULL SPAN (3.3GHz). For MSA458, it is set in/to the range from 200kHz to 5GHz, ZERO SPAN or FULL SPAN (8.5GHz).

5) Reference level key

The reference level is set with this key. It can be set in the range from +10dBm to –60dBm by 1dB step.

6) Resolution bandwidth key

The resolution bandwidth is set with this key. It can be set in the range from 3kHz to 3MHz and to AUTO.

7) Video bandwidth key

The video bandwidth is set with this key. It can be set in the range from 100Hz to 1MHz and to AUTO.

8) AUTO tuning key

When pushing this key, the spectrum with the maximum level is searched within full span (3.3GHz @ MSA438/438TG/438E and 8.5GHz @ MSA458), and then it is adjusted to the center of the screen, and the optimum setting parameters are set. In case of zero span, full span, input signal level lower than –40dBm and input frequency lower than 50MHz, this function doesn't work correctly.

9) Measuring function key

Available for Channel power, Adjacent channel leakage power, Occupied frequency bandwidth, Electric field strength, Magnetic field strength measurement and Frequency counter (factory option)

10) Calculation function key

Available for Max hold, Min hold, Average and Over write.

11) Display scale key

The display scale of amplitude axis of 2dB/div , 5dB/div or 10dB/div is selectable with this key.

12) Sweep key

The sweep time is set in the range from 10ms to 30s and to AUTO. And also the detection mode is selected.

13) Hold/Run key

The measurement is stopped or restarted.

14) Marker & Peak search key

The setting and the operation of marker or peak search are performed.

15) Save/Load key

The spectrum or the setting parameters is saved or loaded.

16) Copy key

The screen image is printed on USB printer (option) or stored in USB memory.

17) UTIL key

The setting of subsidiary functions such as label entry, clock, buzzer and others are performed.

18) Display control key

Color, backlight ON/OFF or brightness of backlight are set.

19) Rotary encoder

This is used for the various setting.

20) Power switch

This is for power ON or OFF.

21) Input connector

N(J) connector

22) Indicator for charging condition

Two colors LED indicates the charging conditions of battery.

23) Input connector for DC power source

AC adaptor MA400 is connected.

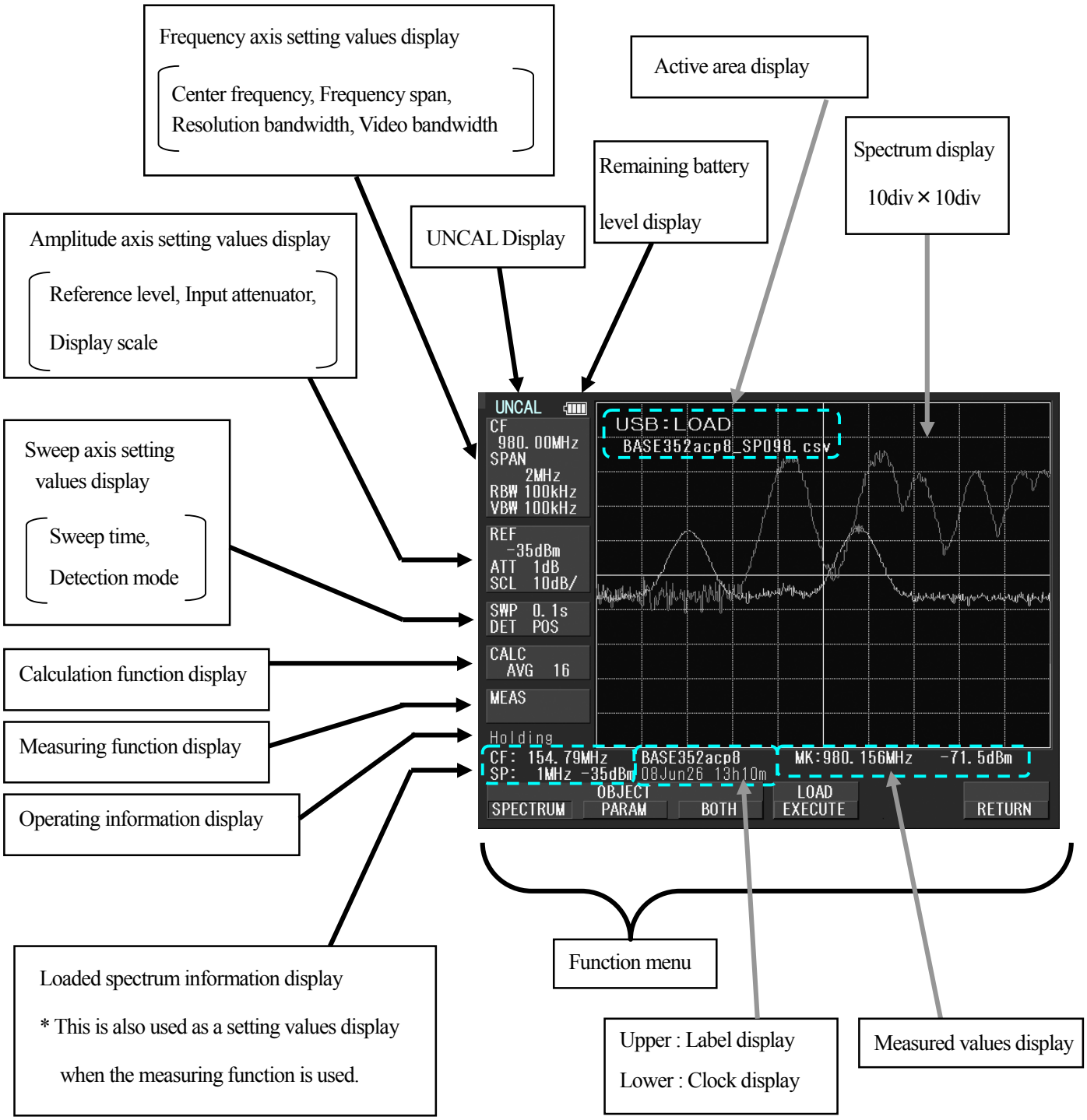
24) USB A plug

USB printer (option) or USB memory is connected.

25) USB B plug

The PC through USB cable MI400(option) is connected.

4. Explanation of Screen



5. Function Menu

5.1 List of function menu

The function menu are shown in the table below. For description of each function, see the appropriate page. For the sequence of selection for the function menu, refer to "5.2 Menu tree".

	Function menu	Key sequence	Page
A	ACP OFFSET	MEAS→(F2)→F2	43
	ACP	MEAS→F2	43
	ACP WIDTH	MEAS→(F2)→F3	43
	ANT	MEAS→(F4)→F1	46
	AVG	CALC→F4	32
B	BACK LT	DSPL→F2	56
	BACK SPACE	FREQ→F6→F5	21
	BAND CNTR	MEAS→(F1)→(F1)→F2	42
	BAND WIDTH	MEAS→(F1)→(F1)→F3	42
	BRIGHT	DSPL→F3	56
	BUZZER	UTIL→F3	61
C	CENTER FREQ →	FREQ→F1	20
	CENTER FREQ ←	FREQ→F2	20
	CH POWER	MEAS→F1	42
	CLEAR	FREQ→F6→F4	21
	CLOCK CONFIG	UTIL→F4	61
	COLOR	DSPL→F1	56
	CONV	MKR→F6	33
D	DELETE	SAVE/LOAD→F3	36
	DEVICE MEM	SAVE/LOAD→F4	36
	DET	SWEEP→F4	29
	DISP CLEAR	SAVE/LOAD→F2→F5	38
E	E/F ANT	MEAS→F4	45
	EncST	FREQ→F4	20
	EMI-C ※1	SAVE/LOAD→F6→F2	52
	EMI-R ※1	SAVE/LOAD→F6→F3	52
F	FREQ COUNT	MEAS→F6	51
I	IMP	REFER→F6	24
K	KeyST	FREQ→F3	20
L	LABEL	UTIL→F1	61
	LOAD	SAVE/LOAD→F2	16
M	M/F PROBE	MEAS→F5	50
	MAX HLD	CALC→F2	31
	MEAS OFF	MEAS→(F1~5)→F6	41
	MIN HLD	CALC→F3	31
	MARKER DELTA	MKR→F2	33
	MARKER NORMAL	MKR→F1	33

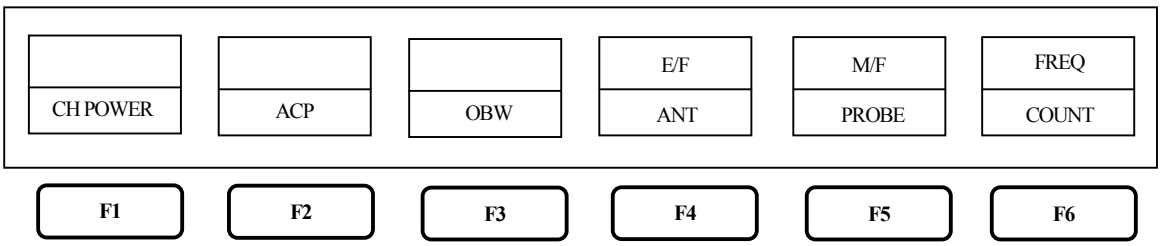
	Function menu	Key sequence	Page
M	MODE	MEAS→(F1～F3)→F1	42 to 44
N	NEXT PEAK	MKR→(F4)→F2	34
	NORMAL	CALC→F1	31
	NORMAL ※1	SAVE/LOAD→F6→F1	52
O	OBW	MEAS→F3	41
	OFSdB	REFER→F5	24
	OFS STEP	REFER→F3	24
	OVRWR	CALC→F5	32
P	PEAK SEACH	MKR→(F5)→F1	34
	PEAK SERCH NORM	MKR→F4	34
	PEAK SERCH ZONE	MKR→F5	34
	PRE SET	SAVE/LOAD→F6	36
	PROBE	MEAS→(F5)→F1	50
R	RATIO	MEAS→(F3)→F2	44
	RBW ALL AUTO	RBW→F3	27
	RBW AUTO	RBW→F2	27
	RBW MANUAL	RBW→F1	27
	REFERENCE CNTR	MEAS→(F2)→F4	43
	REFERENCE WIDTH	MEAS→(F2)→F1→F5	43
S	SAVE	SAVE／LOAD→F1	36
	SCALE 2dB	SCALE→F3	27
	SET MKR	FREQ→F5	20
	SPR. FR ※2	CALC→F6	32
	SWEEP AUTO	SWEEP→F2	29
	SWEEP MANUAL	SWEEP→F1	29
T	T.G. MODE ※3	SWEEP→F6	58
	TRIG	SWEEP→F5	29
	Ten Key MODE	FREQ→F6	20
U	UNIT	REFER→F1～4	24
V	VBW ALL AUTO	VBW→F3	28
	VBW AUTO	VBW→F2	28
	VBW MANUAL	VBW→F1	28
Z	ZONE PEAK	MKR→(F5)→F1	35
	ZONE WIDTH	MKR→(F5)→F2	35

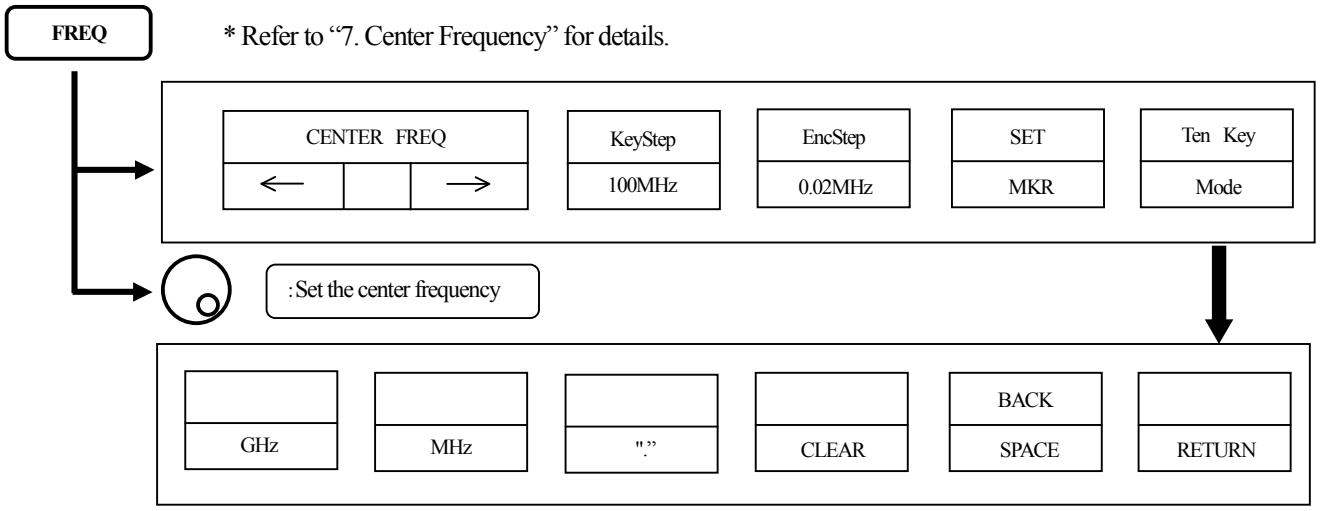
※1 MSA438E only ※2 MSA458 only ※3 MSA438TG only

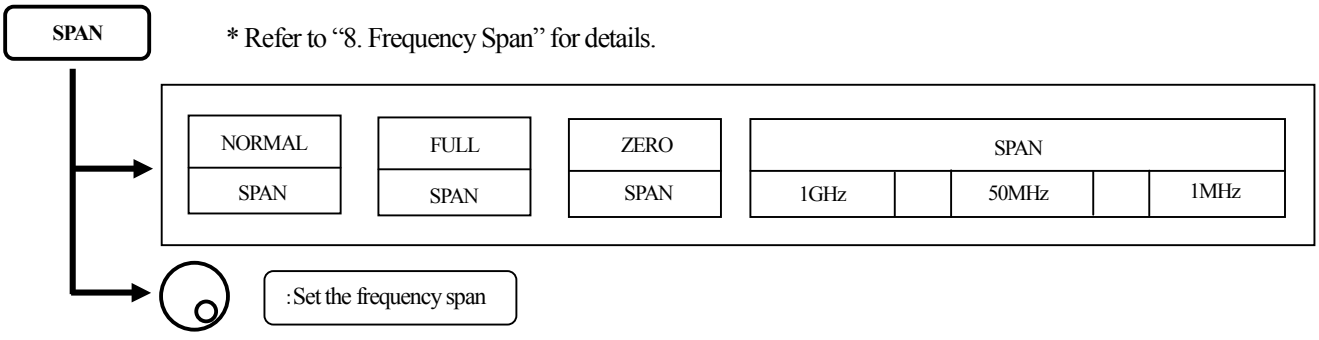
5. 2 Menu tree

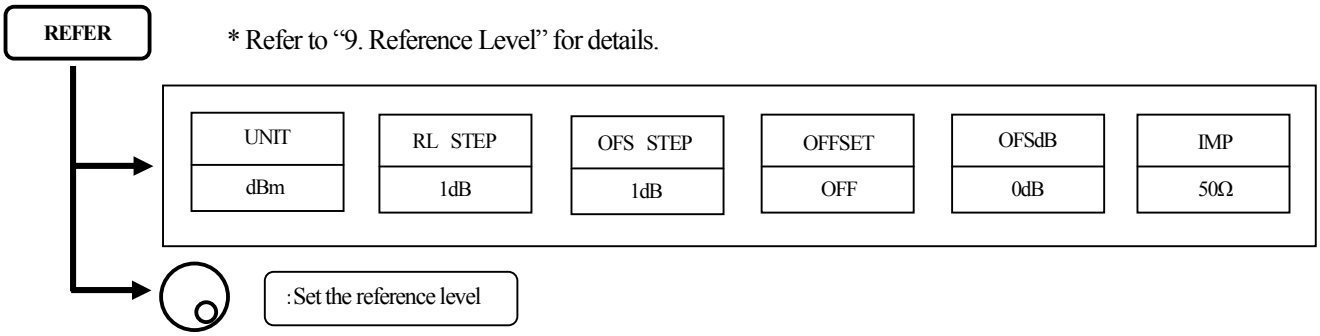
The following is the sequence of selection for the function menu.
The function menu corresponds to the function key of F1 to F6.

"Function menu"



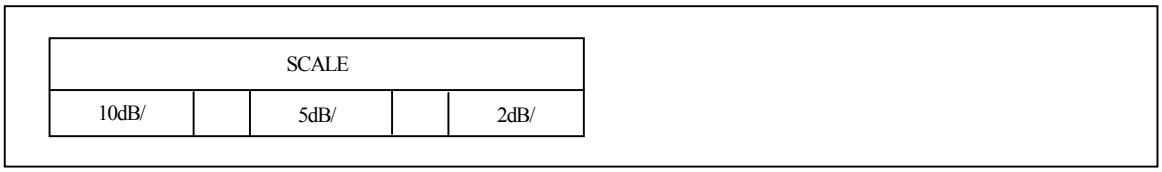






SCALE

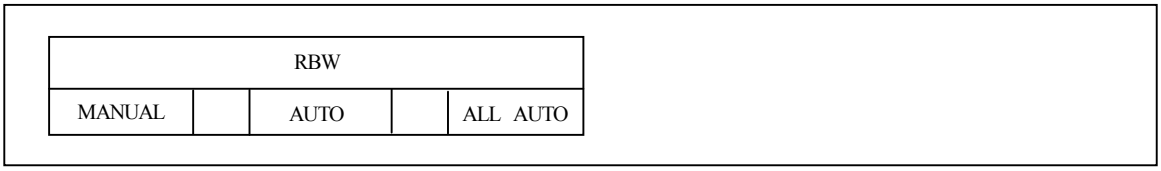
* Refer to “10. Display scale” for details.



: Set the display scale

RBW

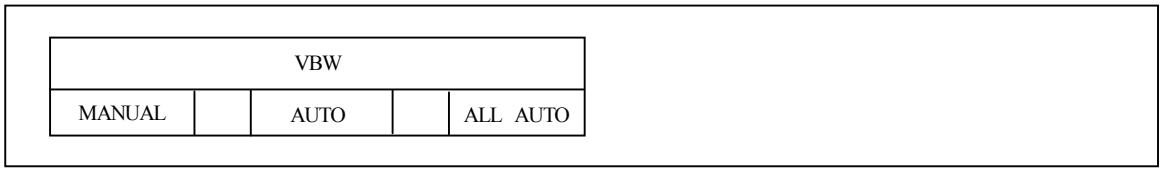
* Refer to “11. Resolution Bandwidth” for details.



: Set the RBW

VBW

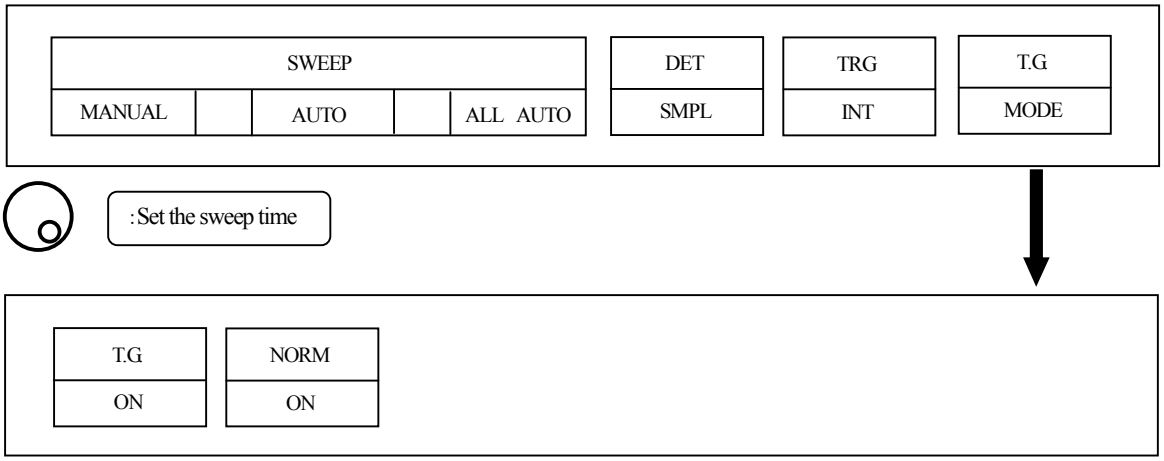
* Refer to “12. Video Bandwidth” for details.



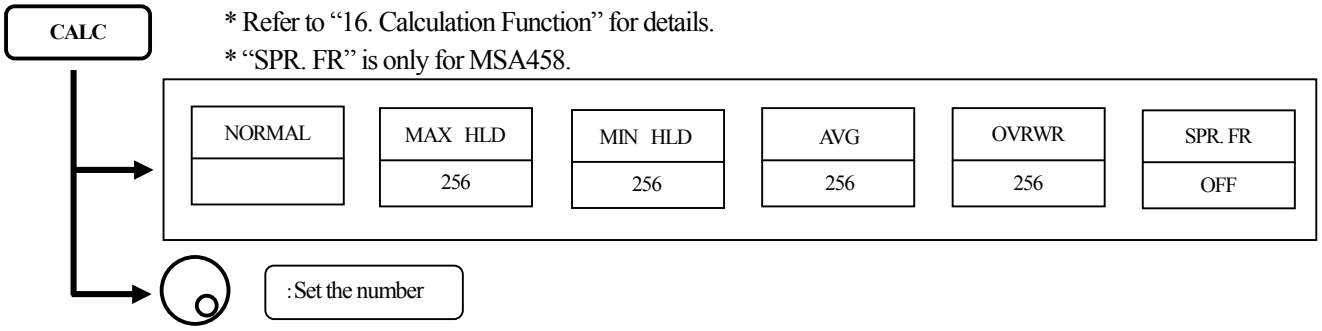
: Set the VBW

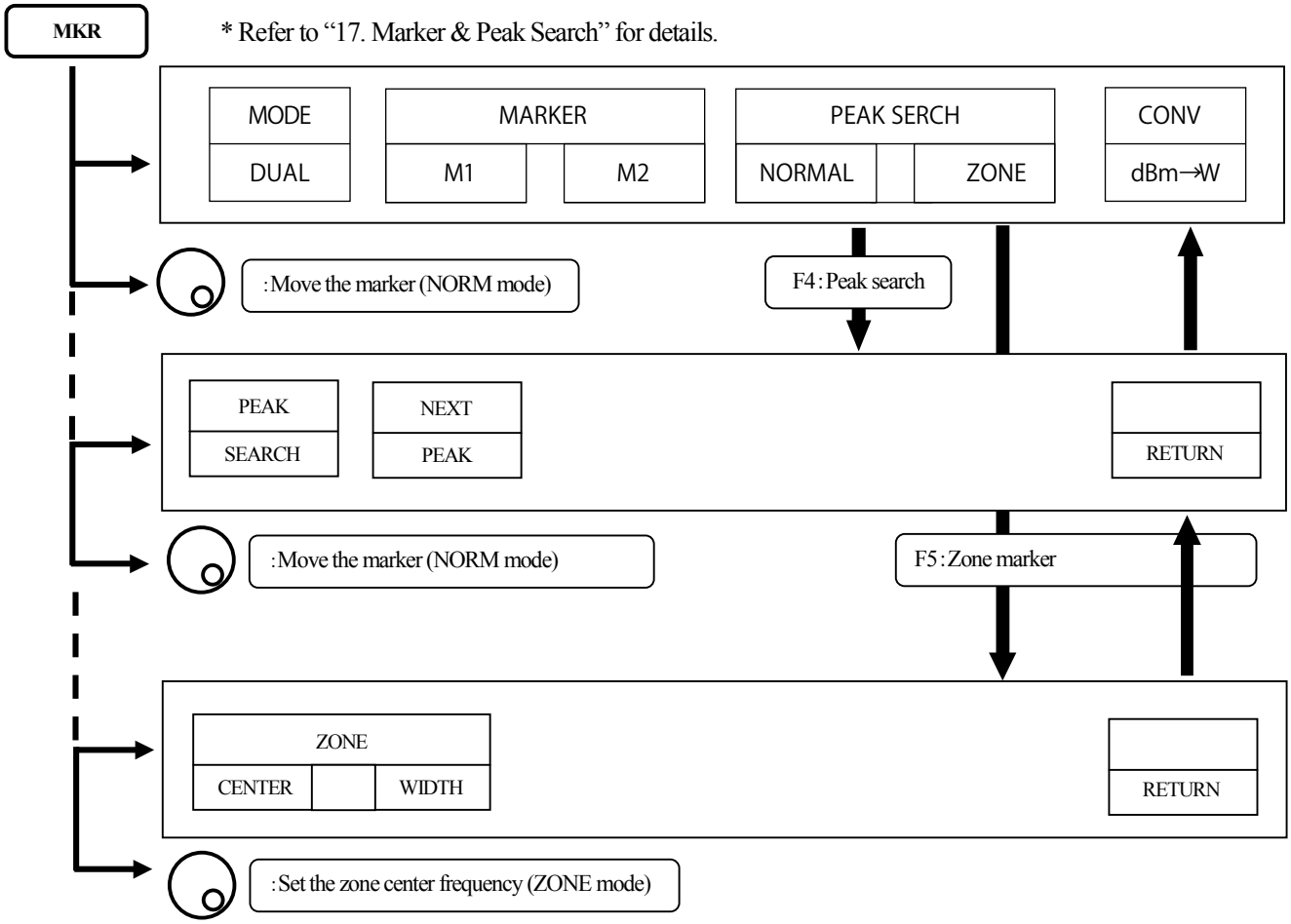
SWEEP

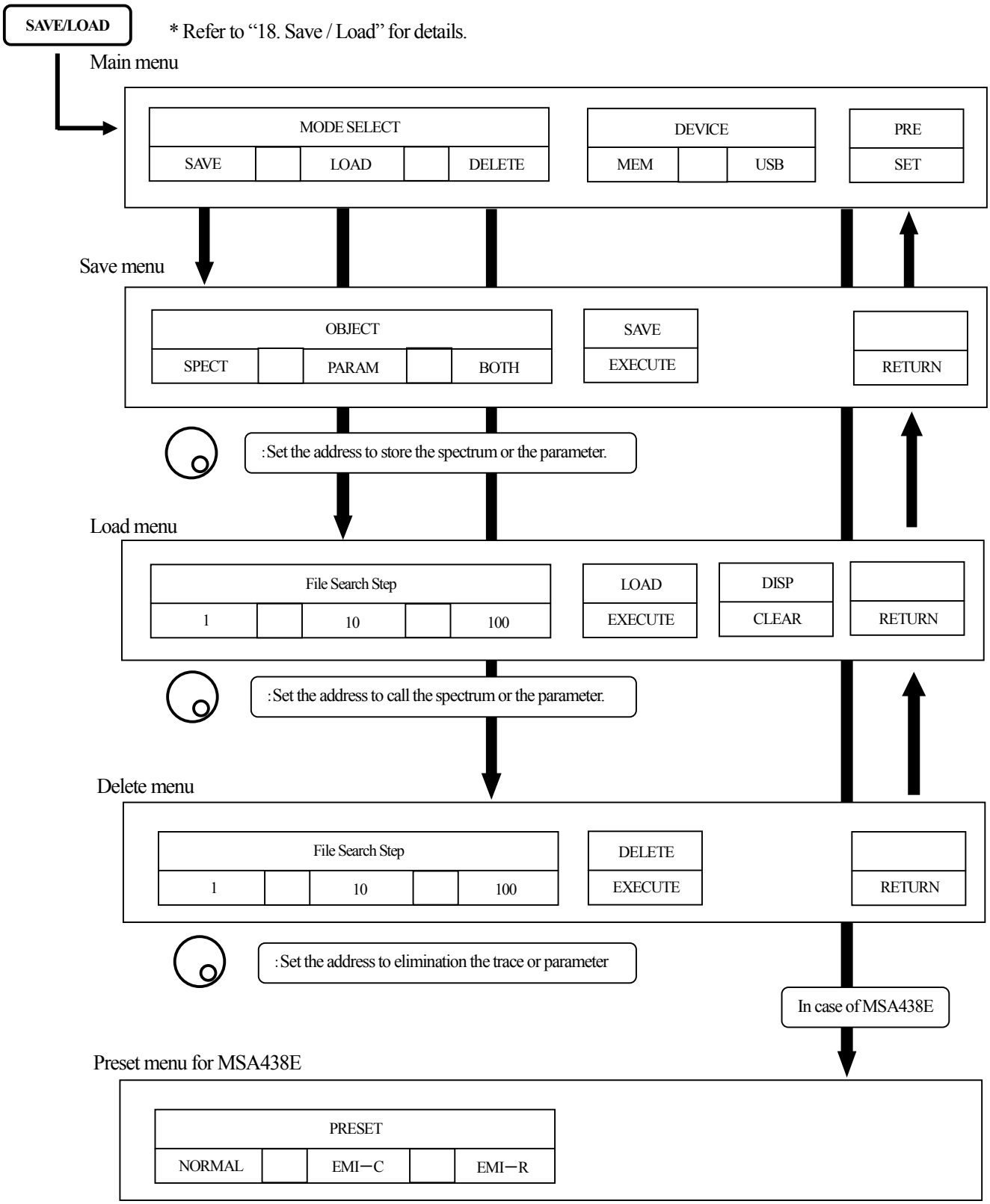
* Refer to “13. Sweep axis / Detection mode” for details.
* T.G. MODE is only for MSA438TG.

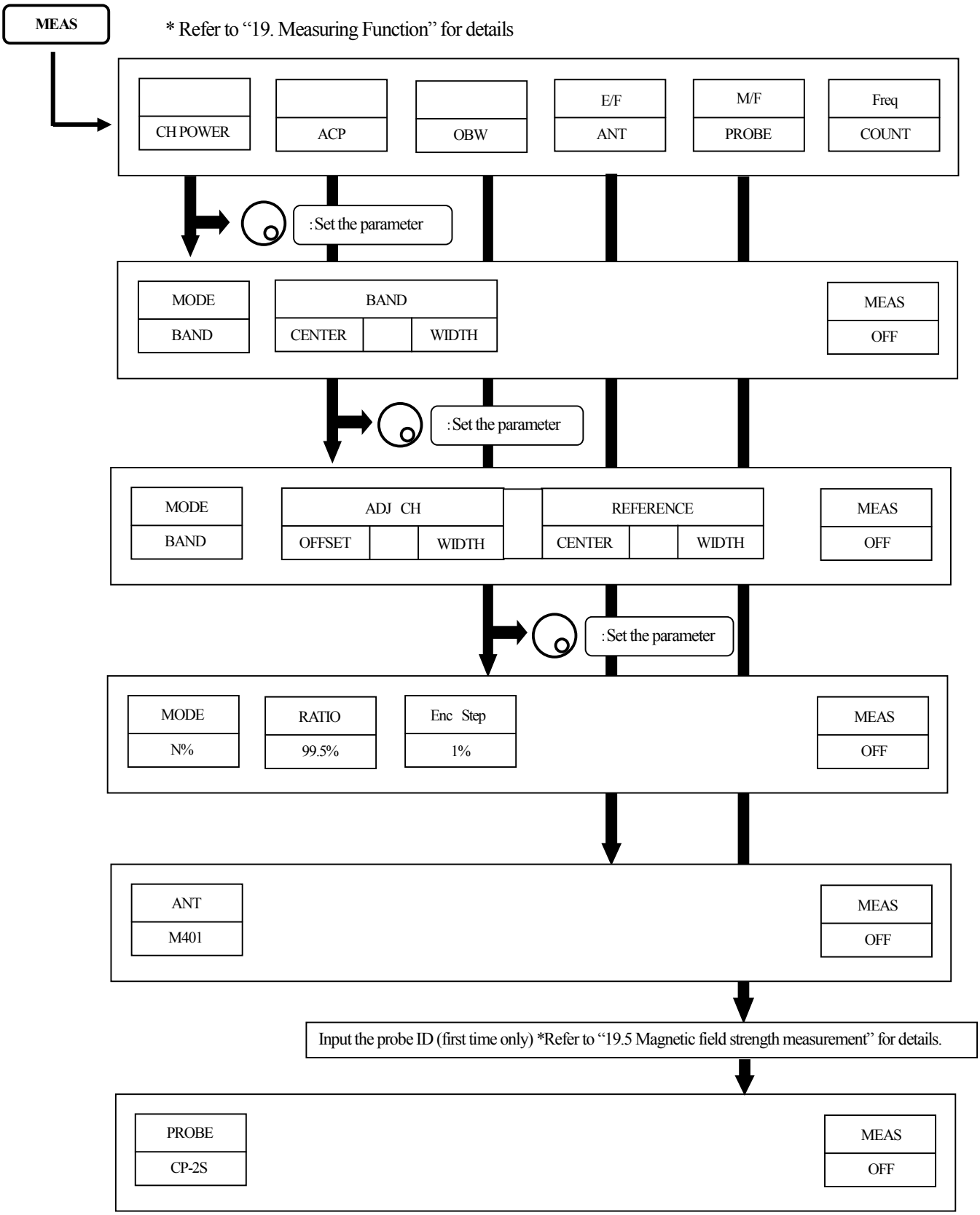


: Set the sweep time


CALC
* Refer to "16. Calculation Function" for details.
* "SPR. FR" is only for MSA458.
NORMAL
MAX HLD
256
MIN HLD
256
AVG
256
OVRWR
256
SPR. FR
OFF
: Set the number

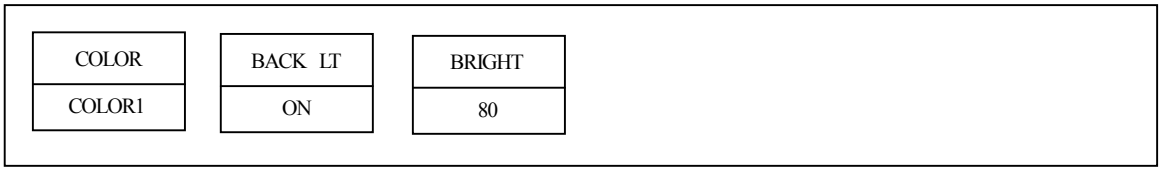

MKR
* Refer to "17. Marker & Peak Search" for details.
MODE
DUAL
MARKER
M1
M2
PEAK SERCH
NORMAL
ZONE
CONV
dBm→W
: Move the marker (NORM mode)
F4 : Peak search
PEAK
SEARCH
NEXT
PEAK
RETURN
: Move the marker (NORM mode)
F5 : Zone marker
ZONE
CENTER
WIDTH
RETURN
: Set the zone center frequency (ZONE mode)


SAVE/LOAD
* Refer to "18. Save / Load" for details.
Main menu
MODE SELECT
SAVE
LOAD
DELETE
DEVICE
MEM
USB
PRE
SET
Save menu
OBJECT
SPECT
PARAM
BOTH
SAVE
EXECUTE
RETURN
: Set the address to store the spectrum or the parameter.
Load menu
File Search Step
1
10
100
LOAD
EXECUTE
DISP
CLEAR
RETURN
: Set the address to call the spectrum or the parameter.
Delete menu
File Search Step
1
10
100
DELETE
EXECUTE
RETURN
: Set the address to elimination the trace or parameter
In case of MSA438E
Preset menu for MSA438E
PRESET
NORMAL
EMI−C
EMI−R


MEAS
* Refer to “19. Measuring Function” for details
CH POWER
ACP
OBW
E/F
ANT
M/F
PROBE
Freq
COUNT
: Set the parameter
MODE
BAND
BAND
CENTER
WIDTH
MEAS
OFF
: Set the parameter
MODE
BAND
ADJ CH
OFFSET
WIDTH
REFERENCE
CENTER
WIDTH
MEAS
OFF
: Set the parameter
MODE
N%
RATIO
99.5%
Enc Step
1%
MEAS
OFF
ANT
M401
MEAS
OFF
Input the probe ID (first time only) *Refer to “19.5 Magnetic field strength measurement” for details.
PROBE
CP-2S
MEAS
OFF

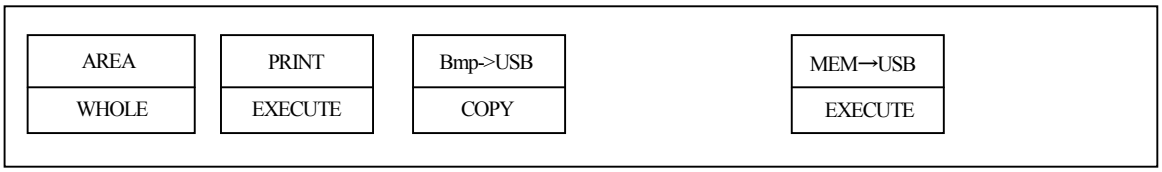
DSPL

* Refer to “21. Screen Control” for details



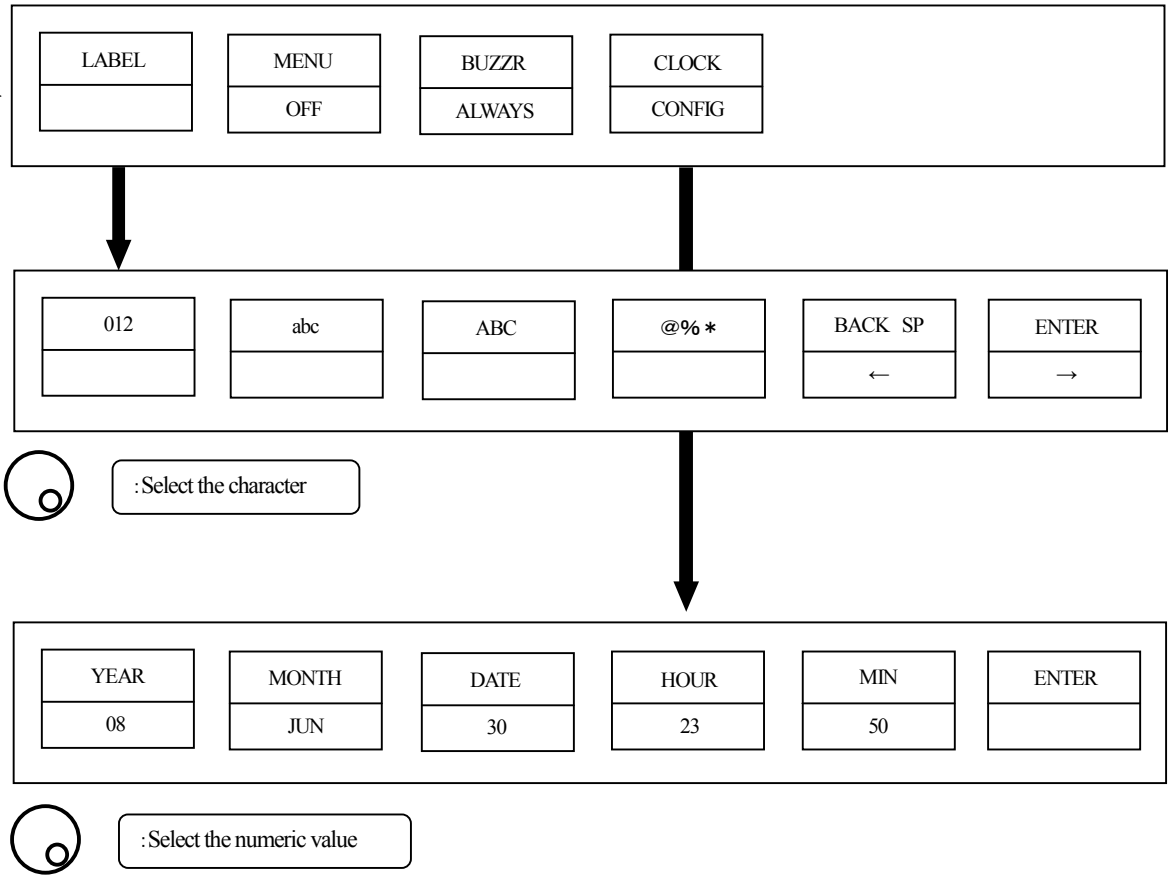
COPY

* Refer to “23. Storage and print of screen image” for details



UTIL

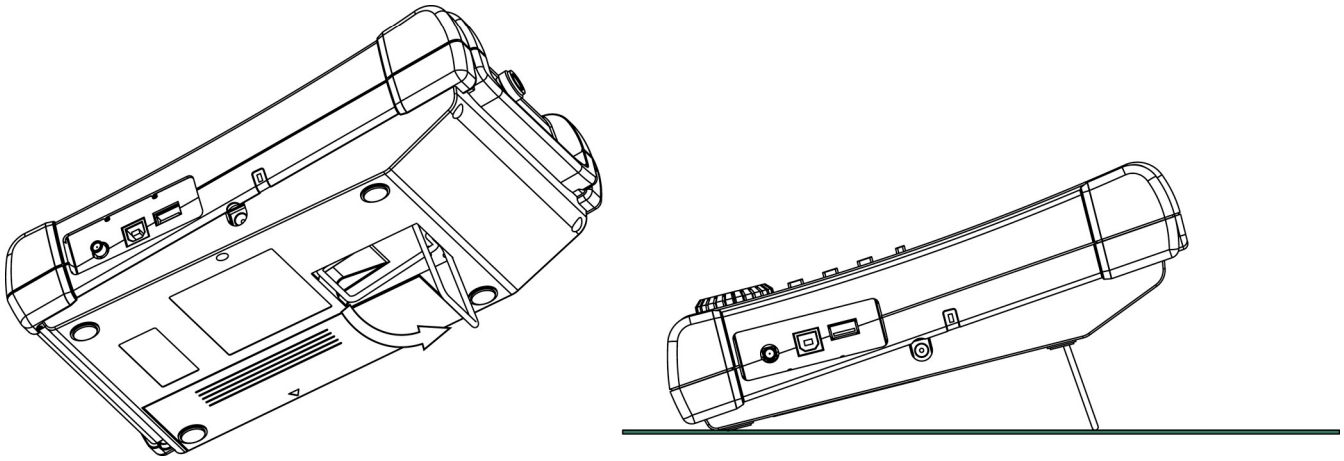
* Refer to “24. Utility Function” for details



6. Preparing for Operation

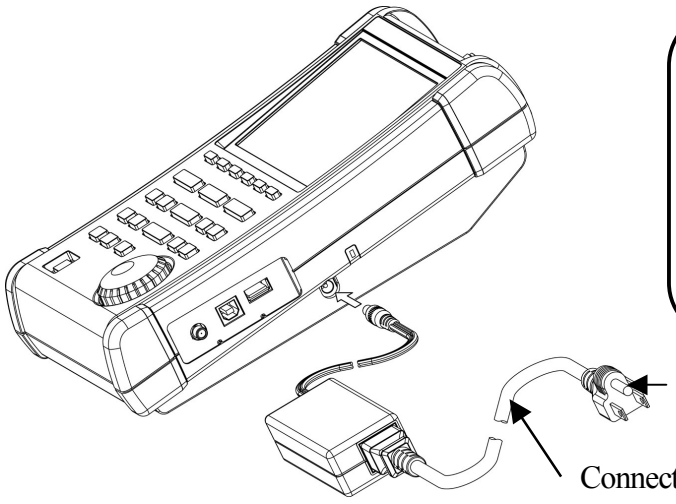
6.1 Stand

Utilize the stand on the back to use the screen in an easier-to-see angle on the desk.



6.2 Connection to power supply

The MA400 AC adapter is both for the use with AC power supply and for charging the MB400 built-in battery (optional). (Charge is started automatically if AC adapter is connected and power-off.)
Connect the adapter as in the figure below and connect the AC plug to the power line (100-240 VAC, 50/60 Hz). For static electricity protection, ground the unit by connecting the three cores if possible. Not grounding the unit can damage it and the object measured. Do not use an AC adapter other than the MA400 supplied with the unit. Using an AC adapter other than the MA400 may cause damage to the unit.



Battery full charge time: approx. 4 hours
Battery operating time: 4 hours maximum (backlight OFF)
*In case of non-operating, at normal temperature, and setting parameters are an initialization.

Please make sure to connect to ground.

Connect to 100 to 240 VAC, 50/60Hz

The battery remainder is divided into five levels and displayed on the screen.
When the mark of the battery remainder is displayed like ▭, the buzzer is sounded even if the setting of buzzer is OFF, and the power is turned off within a few minutes.
Do the necessary work such as a protection of data promptly so that any problem should not be causes even if the power is turned off.

6.3 Battery charge

Under the conditions of power-off and connecting the AC adaptor MSA400 of a standard accessory, the battery is charged. The charging conditions are indicated by two colors LED on the right side as shown in the table below.

Charging condition	Color of LED
On charge	red
Completion of charge	green
No battery	green
Abnormal	blinking in red

※LED is turned off at power-on.

Good usage of battery
Remove the battery when this unit is used with the AC adaptor. Otherwise, the number of charging increases and the battery life might be shortened.

※ Please charge it at the operating temperature of 0℃ to 40℃.

The abnormal condition means that the charging time is more than the time decided beforehand, or that the battery voltage becomes too high.

Caution

Misuse of the battery may cause leaks, abnormal heats, firing or explosion.
For safe use, please observe the following precautions fully.

* Be not short-circuited of the terminal of the removed battery.
* Do not have an impact shock due to throwing, dropping or striking.
* Do not disassemble or remodel the battery.
* Do not throw into a fire or heat the battery.
* Do not leave the battery in the place of the high temperature.
* Do not wet the terminal of the battery.
* Do not cool the battery, and do not charge it in cold outdoor. It causes the performance and battery life to be decreased.
* Do not charge the battery by the methods other than the specification.
* When you keep the battery, please keep it as much as possible in the cool dark place where humidity is low. Moreover, please keep it in the place where child cannot get. The battery not used for a long time might not be charged enough.
* Please exchange the battery for new one (MB400) when operating time shortens extremely.

6.4 Installation of battery

When the battery is installed, remove the battery cover on the back as shown in Fig.1 after turning off power and removing the AC adaptor.

Next, put the battery as shown in Fig.2, move it in the direction of the arrow show in Fig.3, and install it surely.

Use the specified battery MB400. Otherwise, the breakdown and the accident might be caused.

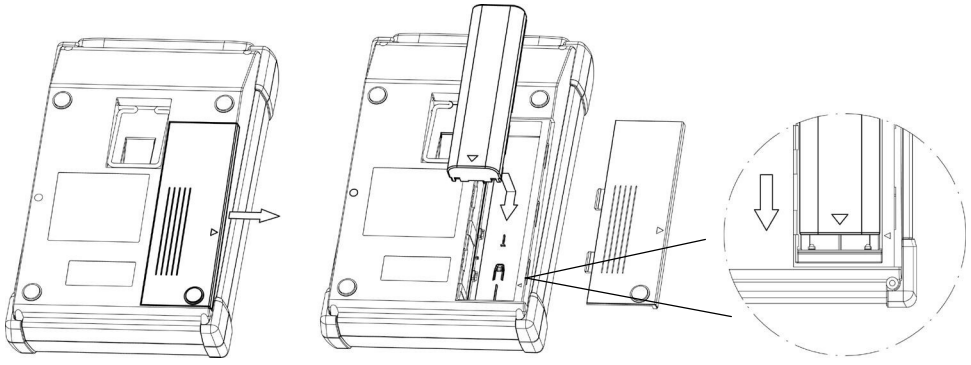
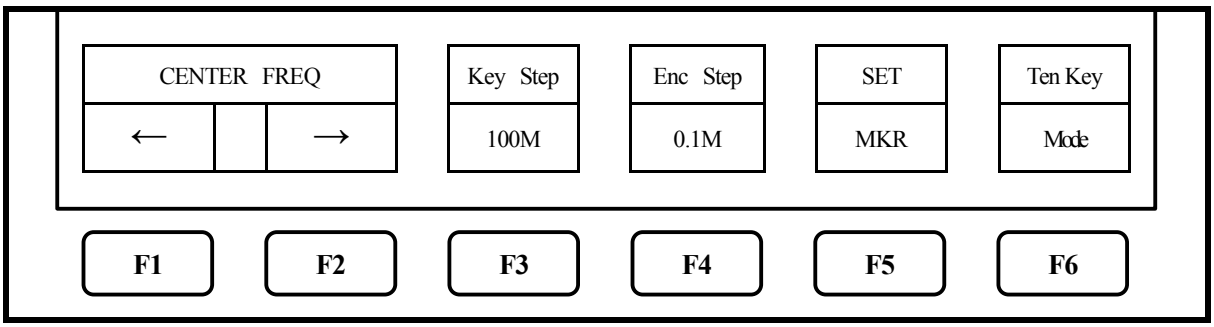


Fig.1 Fig.2 Fig.3

7. Center Frequency <FREQ>

When **FREQ** is pushed, the following function menu is displayed.



* Center frequency setting range : 0 to 3.3GHz@MSA438(E/TG), 0 to 8.5GHz@MSA458
* The center frequency may shift for a while (up to 10 sec.), after setting is changed.

7.1 Setting with step keys ([F1], [F2])

1. When **F1** is pushed, the center frequency decreases in the set step size.
2. When **F2** is pushed, the center frequency increases in the set step size.
3. Setting step size:

When **F3** is pushed, the step size is changed according to the following.

→ AUTO → 20kHz → 100kHz → 1MHz → 10MHz → 100MHz →

AUTO : The step size is 1/10 of the frequency span.
However, only for 500kHz frequency span, the step size is set to 40kHz.
AUTO is recommended in normal use.

7.2 Setting with encoder

1. By rotating , the center frequency is changed in the set step size.
2. Setting step size:

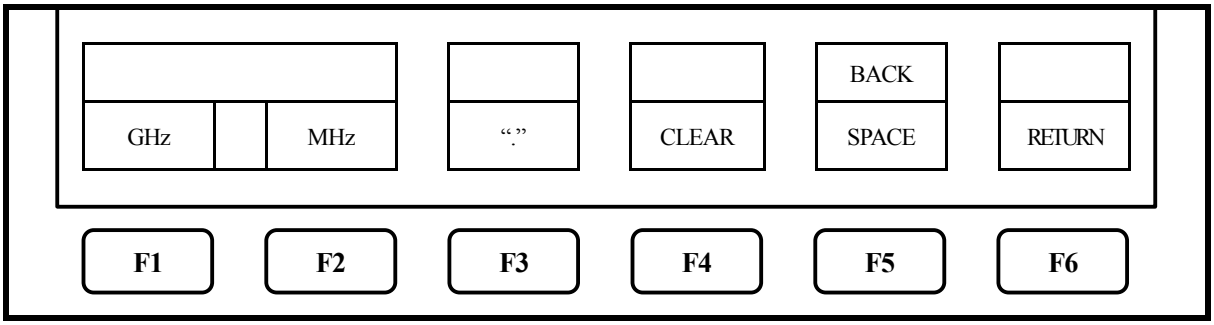
When **F4** is pushed, the step size is changed according to the following.

→ AUTO → 20kHz → 100kHz → 1MHz → 10MHz → 100MHz →

AUTO : The step size is 1/500 of the frequency span.
However, if the frequency span is less than 5MHz, the step size is set to 20kHz.
AUTO is recommended in normal use.

7.3 Setting with numeric key

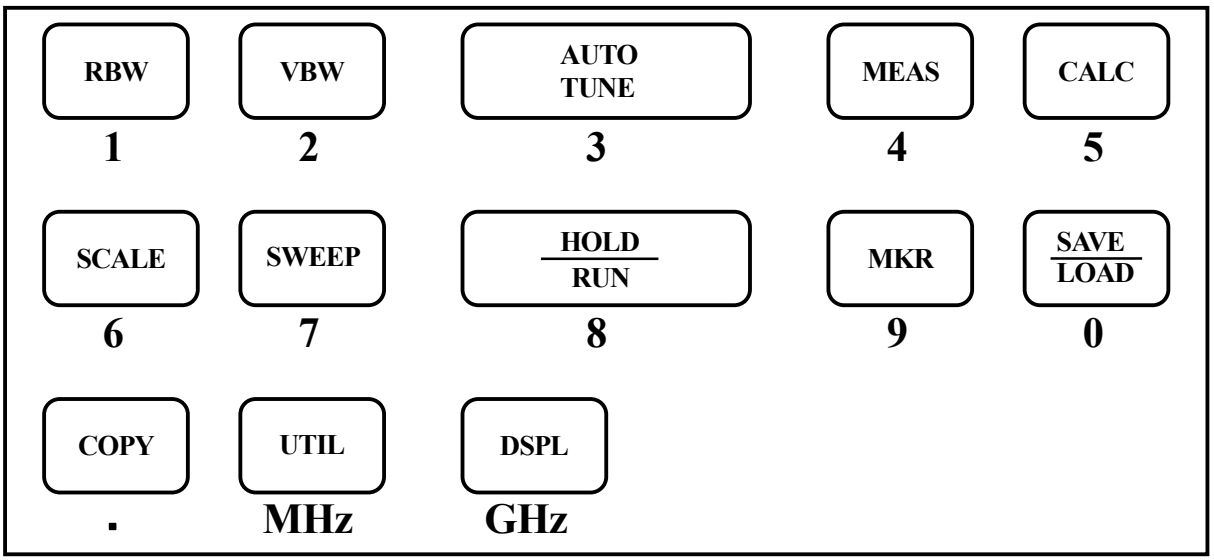
1. When **F6** is pushed, the following function menu is displayed.



2. **F1** , **F2** and **F3** correspond to <GHz>, <MHz> and <. >
F4 and **F5** correspond to <CLEAR> and <BACK SPACE>.
Changing of center frequency by encoder is available in Ten Key Mode.

3. The center frequency can be input directly according to "Numeric Key Mapping Diagram" as follows.

"Numeric Key Mapping Diagram"



4. The center frequency is determined by inputting of the unit of frequency.
For inputting of the unit, **UTIL** and **DSPL** are available.
(**F1** and **F2** are also available.)
* Any figures below the setting resolution (20kHz) will be truncated.

5. Change of setting

The setting can be changed before pushing the unit key.

F4 : The setting values are cleared.

F5 : The last input digit is deleted.

6. Cancel of Ten Key Mode

By pushing **FREQ** or **F6**, the function menu is returned.

7.4 According to marker position

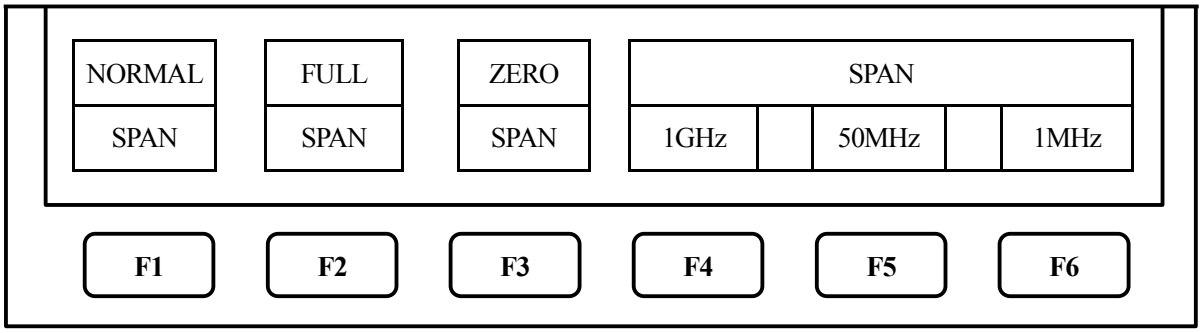
When **F5** is pushed, the center frequency is set according to the frequency of current marker position.

* Any figures below the setting resolution (20kHz) will be truncated.

* When the marker is not displayed, this operation is invalid. (The function menu disappears.)

8. Frequency Span <SPAN>

When **SPAN** is pushed, the following function menu is displayed.



By operating **SPAN** → ◯, the frequency span is set.

MSA438 / MSA438E / MSA438TG

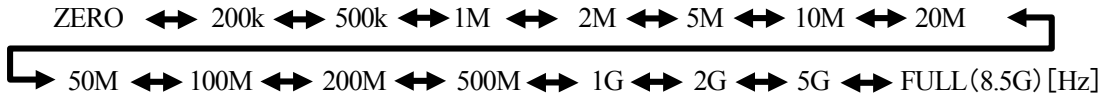
By rotating ◯, the frequency span is changed in the specified step size as follows.

ZERO ↔ 200k ↔ 500k ↔ 1M ↔ 2M ↔ 5M ↔ 10M

↔ 20M ↔ 50M ↔ 100M ↔ 200M ↔ 500M ↔ 1G ↔ 2G ↔ FULL(3.3G)[Hz]

MSA458

1. By rotating , the frequency span is changed in the specified step size as follows.



2. By pushing **F2** , the frequency span is set to FULL SPAN.
   Under such a condition, it returns to former span when is turned by rotation.
3. By pushing **F3** , the frequency span is set to ZERO SPAN.
4. When **F1** is pushed and then the setting is FULL or ZERO span, the frequency span is returned to the last setting.
5. By pushing **F4** ~ **F6** , the frequency span in function menu is set.

■ Switching frequency band

MSA458 has three frequency bands.

Frequency band	Measured frequency range
Base band	50kHz to 3.5GHz
Band 1-	3.3GHz to 6.3GHz
Band 1+	6.1GHz to 8.5GHz

The frequency band is automatically set to the appropriate band based on the center frequency and span.

(At the span less than 200MHz, only one band is used.)

When the setting frequency range belongs to two bands, the lower band has a priority.

The frequency connection point of two bands is fixed as follows.

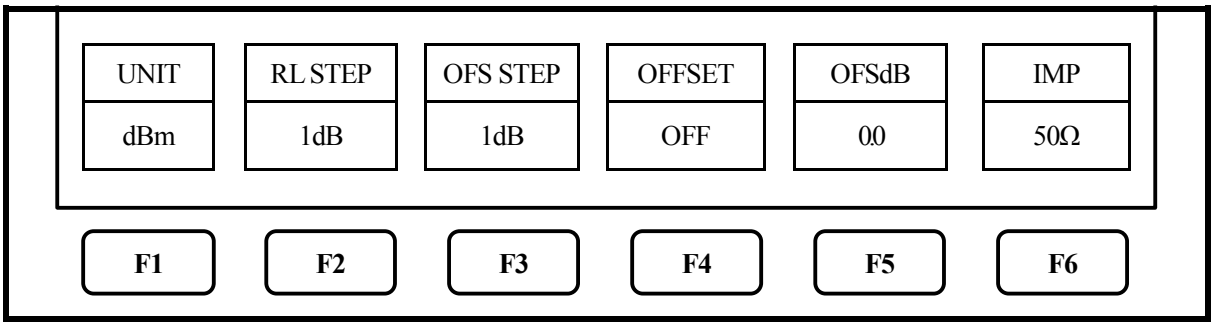
Two bands	Frequency connection point
Base band and Band 1-	3.4GHz
Band 1- and Band 1+	6.2GHz

Note: The spectrum may change a little at the frequency connection point.

For the accurate measurement, center frequency and span should be set as the measured frequency range is in one band.

9. Reference Level <REFER>

When [REFER] is pushed, the following function menu is displayed.



9.1 Setting of reference level

By rotating ◎, the reference level is changed.

(Refer to "9.7 Reference level setting range for each unit" for details.)

9.2 Change of unit of amplitude axis

When [F1] is pushed, the unit is set as follows.

dBm → dBμV → dBmV → dBV →

9.3 Setting of step size of reference level

By pushing [F2], the step size is changed to 10dB or 1dB.

9.4 On-off setting of offset

By pushing [F4], the on-off setting is changed.

ON/OFF : The setting of offset is valid/invalid.

9.5 Setting of offset level

1. By operating [F5] → ◎, the offset of reference level is set.

   When external amplifier or attenuator is used, the display level can be matched by the offset.

   The setting range is -50.0 to 50.0dB.

   The reference level is displayed including the offset.

   * If the offset is set, "OFS" is displayed in Amplitude axis setting values display area.

   Furthermore, the level at the marker point is displayed including the offset.

   * If the unit is changed to dBμV, dBmV, dBV or W, the offset is automatically changed.

2. By pushing [F3], the step size of offset is changed. (10dB, 1dB, 0.1dB)

9.6 Setting of input impedance

By pushing **F6** , the input impedance (50Ω /75Ω) is selected.

The conversion of reference level is automatically executed.

When the input impedance is set to 75Ω with adapter MA301 (50Ω/75Ω impedance converter), the reference level is displayed including offset and conversion of 75Ω.

* When "75Ω" is selected, "75Ω" is displayed in Amplitude axis setting values display area, and the offset is set to 5.7dB (insertion loss of MA301). Moreover, the offset can be changed.

When the unit at marker point is set to W, V, V/m or other, it is converted correctly from dBm.

* Be sure to attach adapter MA301(50Ω /75Ω impedance converter), when "75Ω" is selected.

9.7 Reference level setting range for each unit

Unit	dBm	dBμV	dBmV	dBV
Maximum	10	117	57	-3
Minimum	-40	67	7	-53
Minimum (shifted spectrum data)	-60	47	-13	-73

"Available unit in measuring function"

Unit	dBμV/m (Electric field strength measurement)							dBμA/m (Magnetic field strength measurement)
Setting	M401	M402	M403	M404	M405	M406	M407	CP-2S
Maximum	143	146	149	151	138	159	141	160～203
Minimum	93	96	99	101	88	109	91	110～153
Minimum (shifted spectrum data)	73	76	79	81	68	89	71	90～133

* When the reference level is set between "Minimum" and "Minimum (shifted spectrum data)", the spectrum of "Minimum" is shifted and displayed on the screen.
* When the reference level is set below "Minimum", "S/W AMP" is displayed in Amplitude axis setting values display area on the screen.

Calculating formula (conversion from dBm)

- A[dBμV]＝107＋X[dBm]　● B[dBmV]＝47＋X[dBm]　● C[dBV]＝-13＋X[dBm]
- D[dBμV/m]＝68.8/λ×√(X/Gar)[dBm]　λ: Wavelength[m]　Gar: Antenna absolute gain[times]
- E[dBμA/m]＝107＋X＋F[dBm]　F: Probe calibration coefficient[dB] ※ changes depending on the frequency.

9.8 Relation between reference level and ATT/AMP (at dBm)

Internal input attenuator (ATT) and IF amplifier (AMP) are automatically set to the optimum values based on the reference level (REFER). (The input attenuator cannot be set independently.)

REFER (dBm)	ATT (dB)	AMP (dB)
10	25	0
9	24	0
8	23	0
7	22	0
6	21	0
5	20	0
4	19	0
3	18	0
2	17	0
1	16	0
0	15	0
-1	14	0
-2	13	0

REFER (dBm)	ATT (dB)	AMP (dB)
-3	12	0
-4	11	0
-5	10	0
-6	9	0
-7	8	0
-8	7	0
-9	6	0
-10	5	0
-11	4	0
-12	3	0
-13	2	0
-14	1	0
-15	0	0

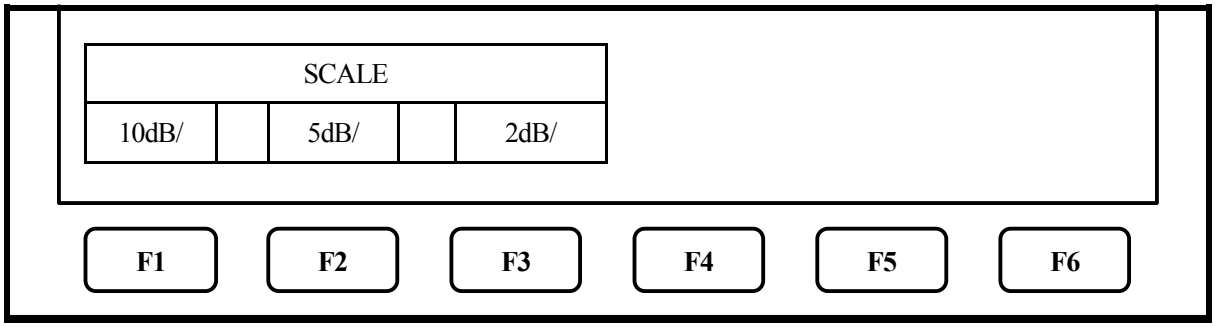
REFER (dBm)	ATT (dB)	AMP (dB)
-16	20	21
-17	19	21
-18	18	21
-19	17	21
-20	16	21
-21	15	21
-22	14	21
-23	13	21
-24	12	21
-25	11	21
-26	10	21
-27	9	21
-28	8	21

REFER (dBm)	ATT (dB)	AMP (dB)
-29	7	21
-30	6	21
-31	5	21
-32	4	21
-33	3	21
-34	2	21
-35	1	21
-36	5	26
-37	4	26
-38	3	26
-39	2	26
-40	1	26

* When the input signal level is higher than the proper level for 1st mixer's terminal, harmonics distortion and spurious are generated.
  This product is designed so that the input signal level of 1st mixer is determined to proper level based on the reference level.

10. Display Scale <SCALE>

When **SCALE** is pushed, the following function menu is displayed.

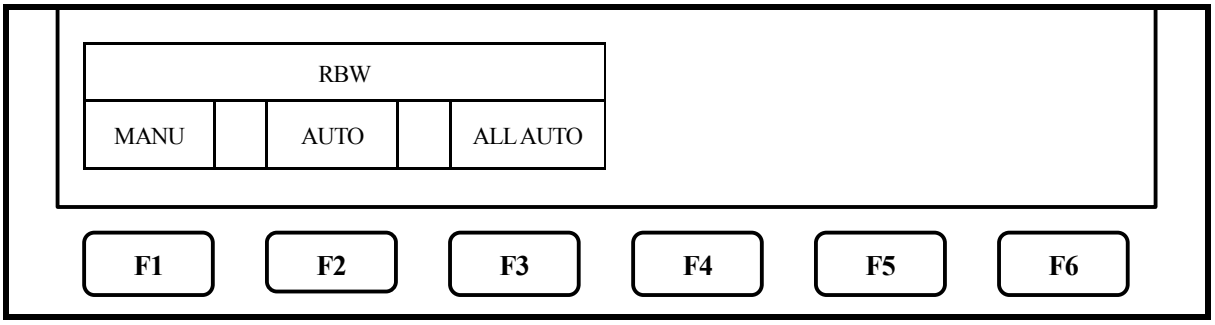


10.1 Setting with function key

1. By pushing **F1** , 10dB/div display scale is set.
2. By pushing **F2** , 5dB/div display scale is set.
3. By pushing **F3** , 2dB/div display scale is set.

11. Resolution Bandwidth <RBW>

When **RBW** is pushed, the following function menu is displayed.



11.1 MANUAL mode

By pushing **F1** or rotating , MANUAL mode is set.

By rotating , RBW is set as follows.

MSA438/438TG/458 : 3kHz ◆▶ 10kHz ◆▶ 30kHz ◆▶ 100kHz ◆▶ 300kHz ◆▶ 1MHz ◆▶ 3MHz

MSA438E : 3kHz ◆▶ 9kHz ◆▶ 30kHz ◆▶ 120kHz ◆▶ 300kHz ◆▶ 1MHz ◆▶ 3MHz

11.2 AUTO mode

By pushing [F2] , the optimum RBW is set based on the frequency span and sweep time.

* When AUTO mode is set, "*" is displayed on the right end of RBW setting value display.

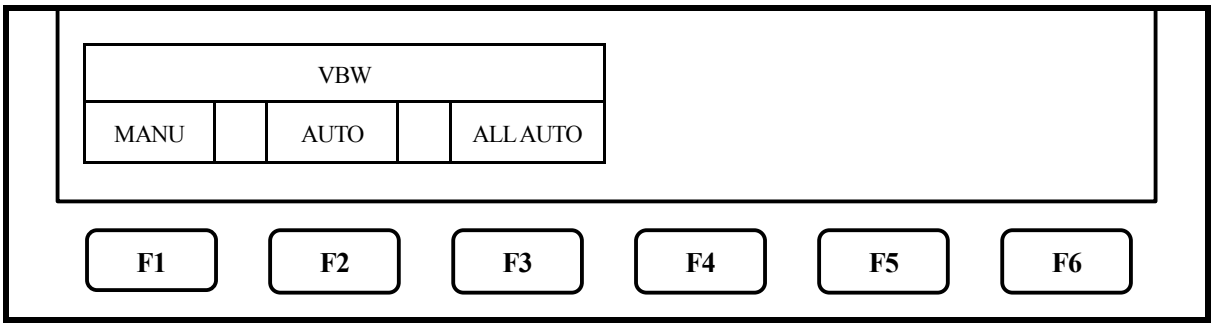
11.3 ALL AUTO mode

By pushing [F3] , the optimum RBW, VBW and sweep time are set based on the frequency span.

* When ALL AUTO mode is set, "*" is displayed on the right end of each setting value display.
* When RBW is set to 3kHz or 10kHz, the selectivity at 60dB becomes larger than an actual value due to SSB phase noise.

12. Video Bandwidth <VBW>

When [VBW] is pushed, the following function menu is displayed.



12.1 MANUAL mode

By pushing [F1] or rotating ◎, MANUAL mode is set.

By rotating ◎ , VBW is set as follows.

100Hz ↔ 300Hz ↔ 1kHz ↔ 3kHz ↔ 10kHz ↔ 30kHz ↔ 100kHz ↔ 300kHz ↔ 1MHz

12.2 AUTO mode

By pushing [F2] , the optimum VBW is set based on the frequency span and sweep time.

* When AUTO mode is set, "*" is displayed on the right end of VBW setting value display.

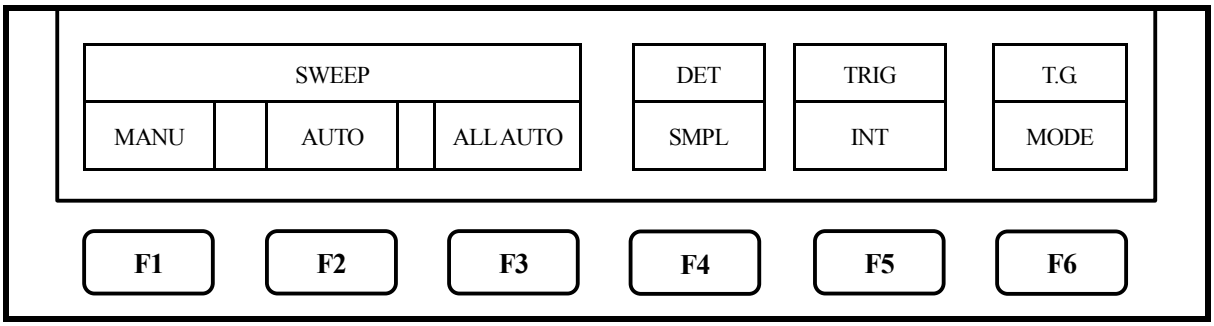
12.3 ALL AUTO mode

By pushing [F3], the optimum RBW, VBW and sweep time are set based on the frequency span.

* When ALL AUTO mode is set, "*" is displayed on the right end of each setting value display.

13. Sweep Axis / Detection Mode <SWEEP>

When [SWEEP] is pushed, the following function menu is displayed.



* T.G. MODE [F6] is only for MSA438TG. This menu is not displayed on MSA438, MSA438E and MSA458. For the details, refer to "22. Tracking Generator Mode".

13.1 MANUAL mode

By pushing [F1] or rotating ◯, MANUAL mode is set.

By rotating ◯, sweep time is set as follows.

10ms ↔ 30ms ↔ 0.1s ↔ 0.3s ↔ 1s ↔ 3s ↔ 10s ↔ 30s

* For MSA438, MSA438E and MSA438TG, when the setting is FULLSPAN, it cannot be set to 10ms.

* For MSA458, when the setting is 5GHz SPAN or FULLSPAN, it cannot be set to 10ms.

13.2 AUTO mode

By pushing [F2], the optimum sweep time is set based on the frequency span and RBW.

* When AUTO mode is set, "*" is displayed on the right end of SWEEP setting value display.

13.3 ALL AUTO mode

By pushing [F3], the optimum RBW, VBW and sweep time are set based on the frequency span.

* When ALL AUTO mode is set, "*" is displayed on the right end of each setting value display.

13.4 Setting of Detection mode (For MSA438E, refer to "20. EMI test")

By pushing [F4], the detection mode is set.

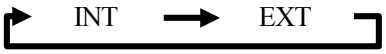
POS (Positive Peak) : The maximum value of the sample points is detected.

SMPL (Sample) : The momentary value of the sample points is detected.

NEG (Negative Peak) : The minimum value of the sample points is detected.

13.5 Setting of Trigger source

By pushing [F5], the trigger source is set.



INT : The sweep is automatically repeated. This setting is normally used.

EXT : When the signal over the trigger level (0.56V) is input to external trigger input, the sweep starts. The sweep is automatically started without an input. (Available only for zero span)

14. AUTO Tuning <AUTO TUNE>

When [AUTO TUNE] is pushed, the spectrum with the maximum level is searched within full span, and then it is adjusted to the center of the screen, and the optimum setting parameters are set.

* Set the frequency span before setting AUTO tuning.

* The function menu is not displayed. AUTO TUNE key is only pushed.

* The auto tuning does not operate normally in the following conditions.

1) Zero span
2) Full span
3) The signal level is –40dBm or lower.
4) The signal frequency is 50MHz or lower.

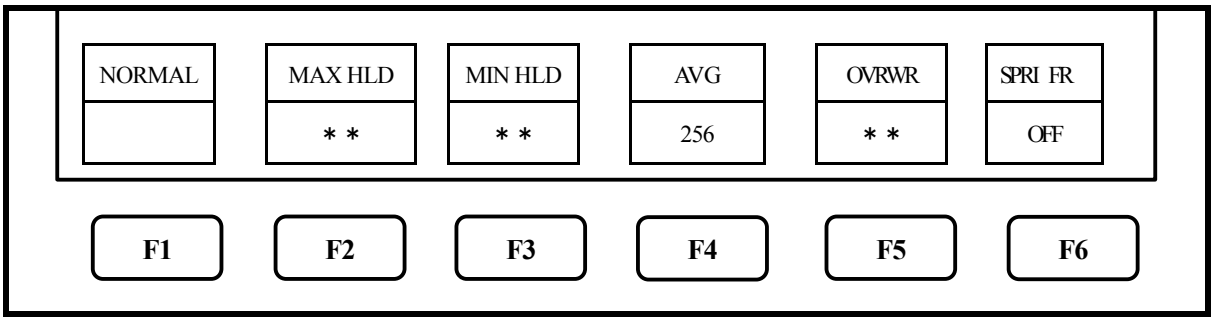
15. Hold / Run <HOLD/RUN>

By pushing [HOLD/RUN], the sweep is switched to halt and continuance.

* The function menu is not displayed. HOLD/RUN key is only pushed.

16. Calculation Function <CALC>

When [CALC] is pushed, the following function menu is displayed.



* By pushing [HOLD/RUN], the sweep is restarted.

* By pushing [F1] ~ [F5], the calculation functions is selected.

By rotating ◯, the number of times of the sweep can be set.

16.1 NORMAL mode

1. When [F1] is pushed, the normal mode is set. The calculation is not performed in this mode. The number of times of the sweep is infinite. This mode is normally used.

   * When this mode is set, "NORMAL" is displayed in the CALC area on the screen. (Refer to "4. Explanation of Screen" for the details.)

16.2 MAX HOLD mode

1. By the operation of [F2] → ◯, the number of times of the sweep in the MAX HOLD mode is set.
2. The update spectrum data is compared with the data left last time at each point, and the larger one is retained and displayed.

   2 ↔ 4 ↔ 8 ↔ 16 ↔ 32 ↔ 64 ↔ 128 ↔ 256 ↔ 512 ↔ 1024 ↔ * * (infinite)

   * When this mode is set, "MAX --- (number of times)" is displayed in the CALC area on the screen. (Refer to "4. Explanation of Screen" for the details.)

16.3 MIN HOLD mode

1. By the operation of [F3] → ◯, the number of times of the sweep in the MIN HOLD mode is set.

2. The update spectrum data is compared with the data left last time at each point, and the smaller one is retained and displayed.

2 ↔ 4 ↔ 8 ↔ 16 ↔ 32 ↔ 64 ↔ 128 ↵
↳ 256 ↔ 512 ↔ 1024 ↔ * * (infinite)

* When this mode is set, "MIN --- (number of times)" is displayed in the CALC area on the screen. (Refer to "4. Explanation of Screen" for the details.)

16.4 AVERAGE mode

1. By the operation of **F4** → ○, the number of times of the sweep in the AVERAGE mode is set.
2. The simple averaging processing is executed at each sweep.

2 ↔ 4 ↔ 8 ↔ 16 ↔ 32 ↔ 64 ↔ 128 ↵
↳ 256 ↔ 512 ↔ 1024

* When this mode is set, "AVG --- (number of times)" is displayed in the CALC area on the screen. (Refer to "4. Explanation of Screen" for the details.)

16.5 OVER WRITE mode

1. By the operation of **F5** → ○, the number of times of the sweep in the OVER WRITE mode is set.
2. The image on the screen is not cleared at each sweep, and the overwriting display is executed.

2 ↔ 4 ↔ 8 ↔ 16 ↔ 32 ↔ 64 ↔ 128 ↵
↳ 256 ↔ 512 ↔ 1024 ↔ * * (infinite)

* When this mode is set, "OVER WR" is displayed in the CALC area on the screen. (Refer to "4. Explanation of Screen" for the details.)

* Only the last spectrum is saved.

16.6 SPURIOUS FREE mode (MSA458 only)

1. By pushing **F6**, the SPRIOUS FREE mode, by which the spurious response peculiarly caused at band 1- and band 1+ is simply deleted, is selected.

* "SPR" is displayed in CALC area on the screen. (Refer to "4. Explanation of Screen" for the details.)

* Differing from base band at which the up-conversion of input frequency is done with a frequency mixer, the spurious response peculiar to band 1- and band 1+ is generated because the down-conversion is done at those two bands.

* About SPURIOUS FREE mode

1. SPURIOUS FREE mode is a mode by which the spurious response peculiarly caused at band 1+ is simply deleted.
2. SPURIOUS FREE mode is especially effective in the measurement of a stationary wave.
3. If SPURIOUS FREE mode is used in measurement of a signal with level change or frequency change, the phenomenon that the level goes down is caused.
4. The noise level goes down a little in case of a noise changing at random. In short, the same phenomenon as MIN HOLD function happens.

* How to judge SPURIOUS response at band 1- and band 1+

The procedure for judging SPURIOUS response at band 1- and band 1+ is as follows.

1. Set the center frequency to < (current setting value) + f >.
2. The spectrum shifting left by f is a correct spectrum, but another spectrum shifting such as left by 2f, left by 3f, right by f, right by 2f or right by 3f is a spurious response.

* "f" should be changed according to SPAN for easy judgment. For reference;
f = SPAN/(10 to 50) (corresponding to 0.2 to 1 div)

Example: judging a spectrum displayed at 6.92GHz
(setting : center frequency 6.92GHz and SPAN 500MHz)

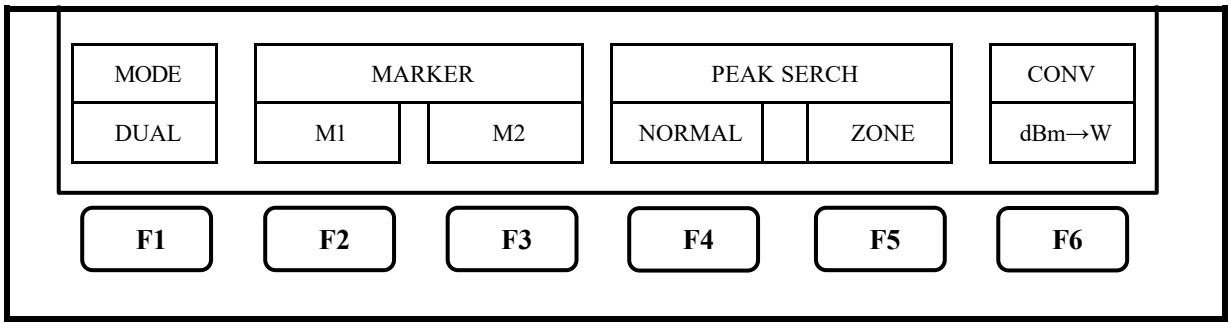
1. Set the center frequency to < 6.92GHz + 500MHz/25 > = 6.94GHz.
2. A spectrum at 6.92GHz (shifting left by f from 6.94GHz) is correct. A spectrum at 6.98GHz (shifting right by 2f from 6.94GHz) is spurious.

* Additionally, a spurious response mentioned above shifting right by 2f at band 1+ is largest, and other spurious response are about 25 to 50dB smaller than that.

17. Marker & peak search <MKR>

When [MKR] is pushed, the following function menu is displayed.

DUAL mode



17.1 Movement and basic function of marker

By rotating ◯, the marker moves. The frequency and the level at the marker point are displayed in the lower right side.

By pushing [F1], the marker mode is selected.

SINGLE → DUAL → OFF

- SINGLE : Single marker or delta marker display
- DUAL : Dual marker display
- OFF : No marker

By pushing [F2] or [F3], an active marker is selected. What is displayed depends on the marker mode.

- SINGLE mode

  NORMAL : A single marker is displayed.

  DELTA : Active marker (＊) and Ref. marker (◇) are displayed.
  The frequency and level are the difference between (Active marker)－(Ref. marker).
  The marker to be operated is the active marker.

- DUAL mode

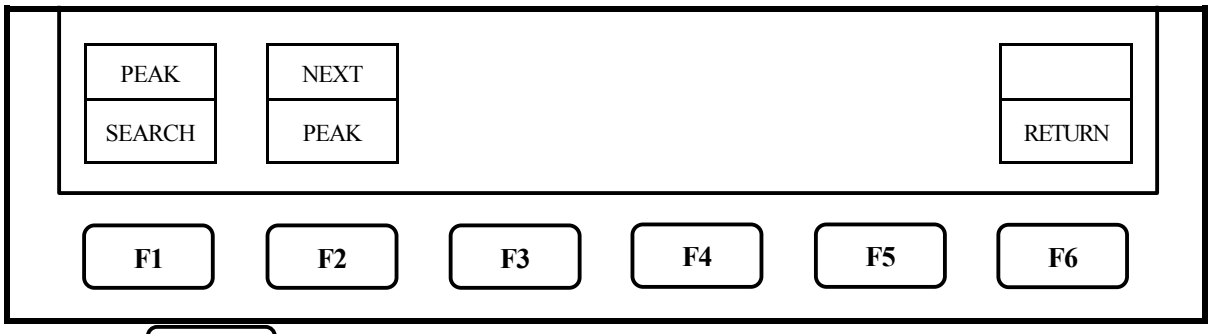
  M1 : 1st marker (＊) is active.

  M2 : 2nd maker (◇) is active.

17.2 Normal peak search

- Menu of normal peak search

When [F4] is pushed, the following function menu is displayed.

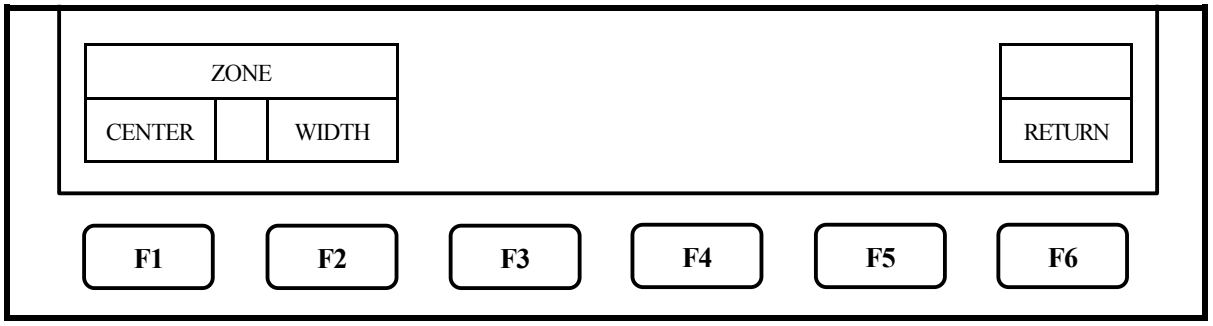


1. When [F1] is pushed, the marker moves to the maximum peak position of spectrums.
2. When [F2] is pushed, the marker moves to the next higher peak of the peak on which the marker is attached. Fifty or less peaks are available.
3. When [F6] is pushed, the function menu is returned to the main menu of maker function.

17.3 Zone peak search

● **Menu of Zone mode**

When [F5] is pushed, the following function menu is displayed.



At the Zone mode, the marker automatically moves to the maximum peak point within the range beforehand set.

When entering this mode, the zone is displayed with thin blue shadow in the spectrum display area.

The marker moves to maximum level within this zone at each sweep.

By the operation of [F4] → ◯, the center of the zone is decided.

By the operation of [F5] → ◯, the width of the zone is decided.

※The marker doesn't move in HOLD.

17.4 Change for unit at maker level

When [F6] is pushed, the unit at marker level is changed.

If the unit of the reference level is dBm, it is changed like [dBm] ↔ [W].

If the unit of the reference level is dBμV, dBmV or dBV, it is changed like

[dBμV, dBmV, dBV] ↔ [V].

If the unit of the reference level is dBμV/m, it is changed like [dBμV/m] ↔ [V/m].

If the unit of the reference level is dBμA/m, it is changed like [dBμA/m] ↔ [A/m].

Moreover, the sub-unit is attached as follows according to the level.

[W] → [W, mW, μW, nW, pW, fW]

[V] → [V, mV, μV, nV]

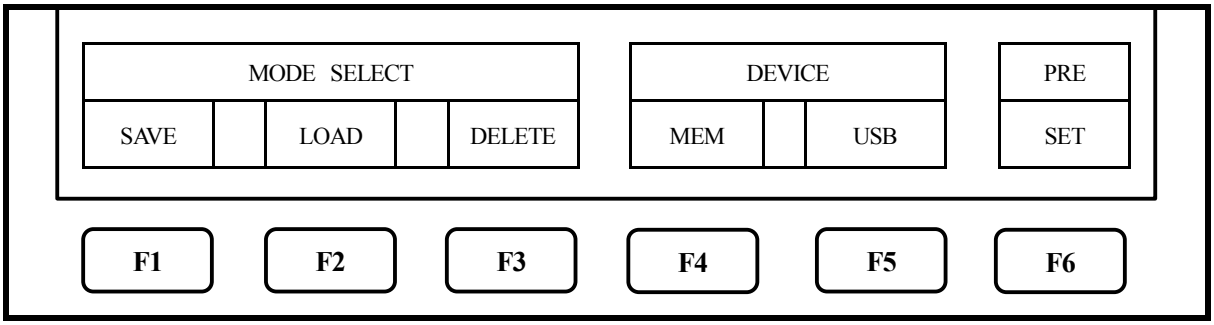
[V/m] → [V/m, mV/m, μV/m, nV/m]

[A/m] → [A/m, mA/m, μA/m, nA/m]

"V/m" is displayed only when the electric field strength measurement is selected.
(Refer to "19.4 Electric field strength measurement".)
"A/m" is displayed only when the magnetic field strength measurement is selected.
(Refer to "19.5 Magnetic field strength measurement".)

18. Save / Load <SAVE/LOAD>

When [SAVE/LOAD] is pushed, SAVE/LOAD menu is displayed as follows.



18.1 Selection of storage device

1. When [F4] is pushed, the built-in flash memory is selected as a storage device.
2. When [F5] is pushed, the external USB memory is selected as a storage device.

※ Install the USB memory in USB A plug on the right side firmly. Refer to the figure below.

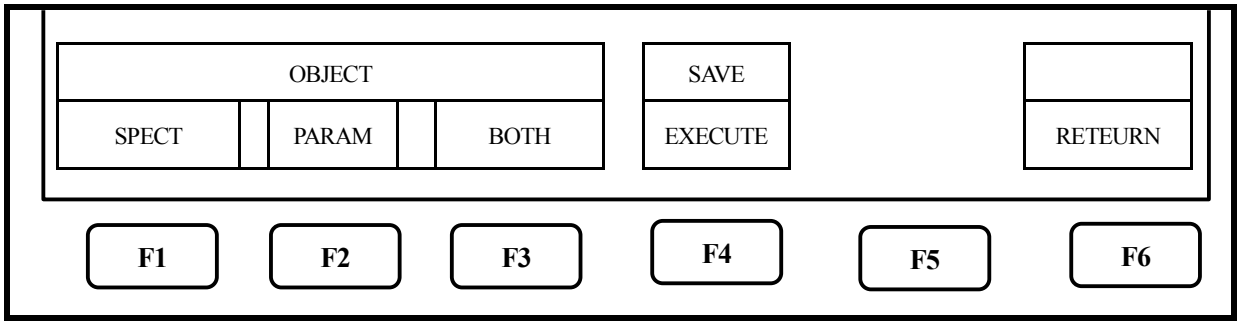
※ If the USB memory is installed again after it is installed once and then removed, the MSA400 series cannot normally recognize it. In that case refer to the following operation.

Method of recognition:

By the operation of [SAVE/LOAD] → [F5], the USB memory is recognized.

18.2 Save function

When [F1] is pushed, SAVE menu is displayed as follows.



1. In this function, the data is stored in the built-in memory or USB memory by CSV format.
   The data stored in USB memory can be used with a personal computer as a CSV file.
   "SVLD" which is a folder for storage is automatically generated and the data is stored in it as a file.

2. The object to be stored is selected with [F1], [F2] or [F3].
   SPECT : The current spectrum on the screen is stored.
   PARAM : The setting parameters are stored.
   BOTH : The spectrum and setting parameters are stored as one file.
   ※ The selected key is displayed like concave.

3. When [F4] is pushed, SAVE is executed.
   The data is stored by the file name displayed in the active area (refer to "4. Explanation of screen").
   As for the file name, refer to "18.3 File name".
   200 or less files can be stored in the built-in memory.
   1000 or less files can be stored in USB memory.

4. When [F6] is pushed, the former menu is displayed.

18.3 About file name

1. The file name is attached to the file stored using this function as follows.

   LABEL__SP001.csv
   ① ②③ ④

   ① The named label is pasted. Refer to "24.1 Label function".
   ② S : The object stored is the spectrum (SPECT).
   P : The object stored is the setting parameters (PARAM).
   SP : The object stored is both of spectrum and setting parameters (BOTH).
   ③ The consecutive three digit number from "000" is automatically attached if ① and ② are same.

This is the extension showing CSV format and is automatically attached.

2. If the label is not named, “MSA” instead of it is attached and the file name becomes below.

   MSA__SP001.csv

3. About file name at the time of storage

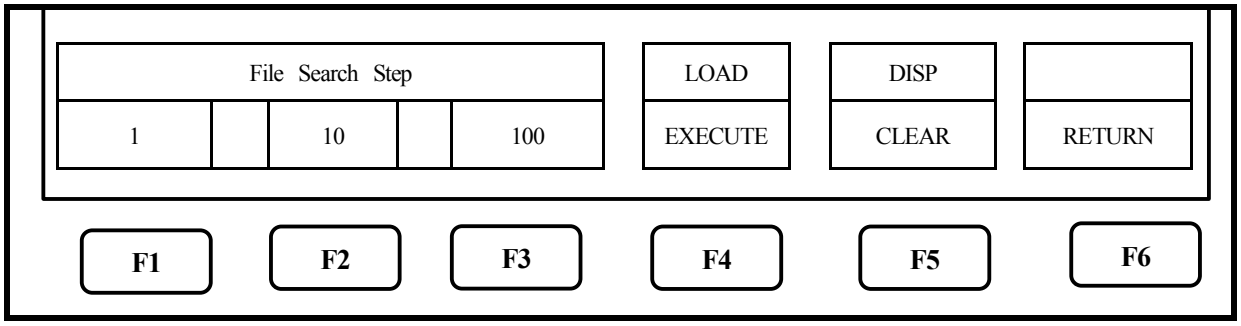
   When SAVE is selected, a candidate of file name is displayed in the active area following above-mentioned regulations.

   When SAVE is executed as it is, the data is stored with that file name. If the file exists in the storage device and ◯ is rotated left before SAVE is executed, those file names are displayed one by one.

   If SAVE is executed with an existing file name displayed, the data is overwritten on it.

18.4 Load function

When [F2] is pushed, LOAD menu is displayed as follows.



1. When ◯ is rotated right and left, the stored file name is displayed one by one from the specified storage device in the active area as follows.

   ① USB : LOAD
   ② MSA__SP012.csv
   ③ 12

   ① The storage device in which the file is stored is displayed.

   (USB: USB memory, MEM: built-in memory)

   ② The file name selected.

   ③ Number attached to file

   The files in the specified folder of the storage device are sorted in alphabetical order. And this shows that number.

2. Selection of number of skips of files to be searched

   By F1 → ◎ , the file is displayed in order of the number attached to it in the active area.

   The number skips each 10 by F2 and each 100 by F3 as well.

   Select it according to the number of stored files.

3. When F4 is pushed, LOAD is executed.

   ※ When SPECT is selected, a spectrum waveform is loaded. The setting parameters of loaded spectrum are displayed in the setting parameters display area.
   [Refer to "4. Explanation of screen" for details.]

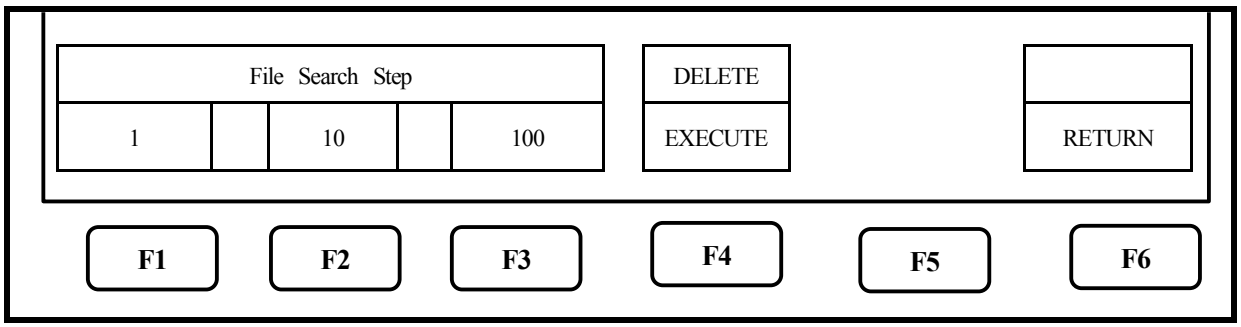
   ※ When PARAM is selected, setting parameters are loaded.

   ※ When the spectrum is loaded, the MSA400 series enters HOLD state and a current spectrum disappears. And then the loaded spectrum is displayed.
   When HOLD/RUN is pushed after then, a loading spectrum and a current spectrum are displayed together.

4. When F5 is pushed, the loaded spectrum can be non-displayed.

18.5 Delete function

When F3 is pushed, DELETE menu is displayed as follows.



1. The file name to be deleted is selected from the specified device with ◎ , and then display it in the active area. As for the number of skips, it is the same as "18.4 Load function".
2. When F4 is pushed, DELETE is executed. The file displayed in the active area is deleted at this time.
3. Repeat 1. and 2. operation, and more than one file can be deleted one by one.

18.6 Presetting (Initialization) (For MSA438E, refer to "20. EMI test".)

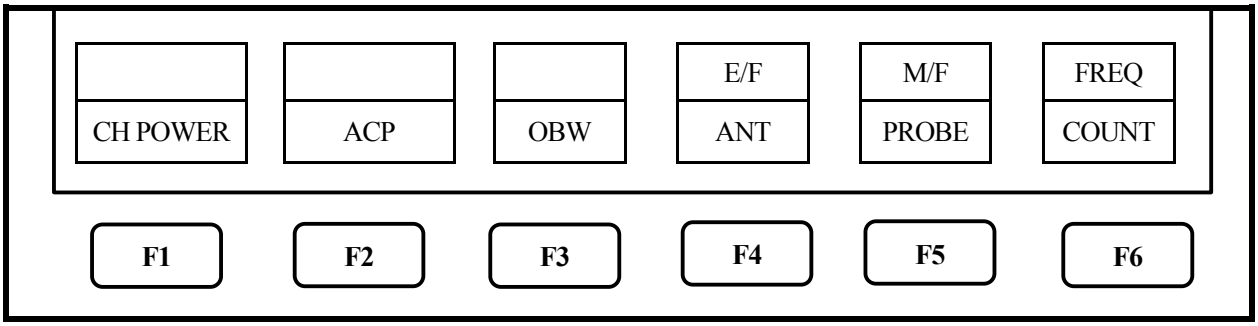
When **F6** is pushed, the setting parameters are reset to the initialization shown below.

"Initialization"

Items	Parameters
Center frequency	1GHz
Frequency span	20MHz
Reference level	10dBm
Offset	0.0dB
Impedance	50Ω
Sweep time	30mS
Detection mode	Sample mode (SMPL)
RBW	100kHz
VBW	30kHz
Display scale	10dB/div

19. Measuring Function <MEAS>

When [MEAS] is pushed, the following function menu is displayed.



The measuring function can be selected as follows.

- **F1** CH POWER ---------- Channel power measurement
- **F2** ACP ---------- Adjacent channel leakage power measurement
- **F3** OBW ---------- Occupied bandwidth measurement
- **F4** E/F ANT ---------- Electric field strength measurement
- **F5** M/F PROBE ---------- Magnetic field strength measurement
- **F6** FREQ COUNT --------- Frequency counter (factory option)

* Once the measuring function is set, when [MEAS] is pushed, the function menu is directly returned to the last setting of the measuring function. In order to stop the measuring function or to select the other measuring function, push [F6] key (MEAS OFF), then the function menu is returned to the main menu of the measuring function.
* Each of the four functions (Channel power, Adjacent channel leakage power, Occupied bandwidth and Frequency counter) and the marker function cannot be used at the same time. When [MKR] is pushed while each of the four functions is selected, the measuring function is stopped.

  Similarly, when the measuring function is selected while using the marker function, the marker function is stopped.
* Although 501 points are displayed on its screen, the number of points calculated in the instrument is all of 1001 points.

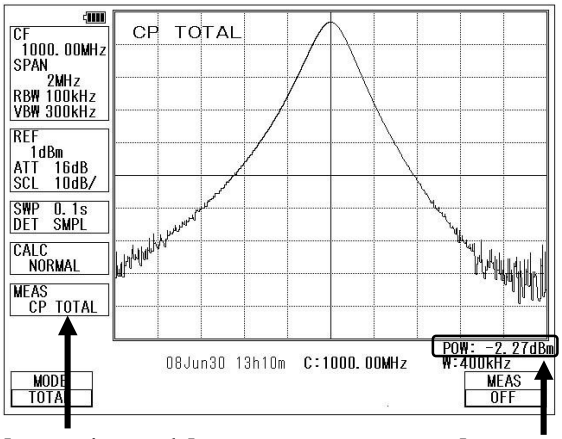
19.1 Channel power measurement <CH POWER> [F1]

The total power in the specified frequency band is measured.

Two modes, TOTAL and BAND, are available.

●TOTAL mode [By pushing [F1] (MODE), TOTAL mode is selected.]

The sum of power in the displayed spectrum specified by center frequency and frequency span is measured.

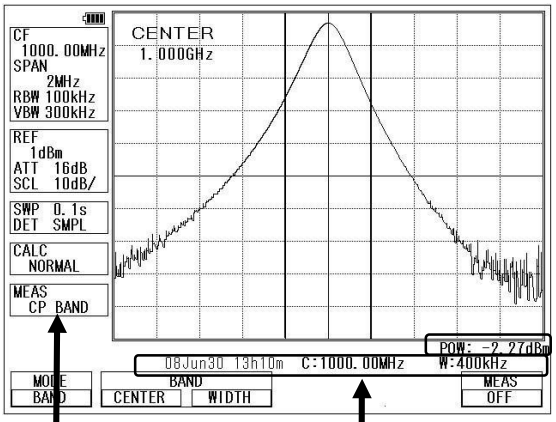


[Measuring mode] [Measured value]

* "CP TOTAL" is displayed in MEAS area on the screen.
* The measured value is displayed at the lower right corner on the screen.

●BAND mode [By pushing [F1] (MODE), BAND mode is selected.]

The sum of power in the band specified by band center and bandwidth is measured.



[Measuring mode] [Setting parameter] [Measured value]

* "CP BAND" is displayed in MEAS area on the screen.
* The measured value and the setting parameter are displayed at the lower on the screen.

1. By [F2] (BAND CNTR) → ◯, the band center is set.
2. By [F3] (BAND WIDTH) → ◯, the band width is set.

19.2 Adjacent channel leakage power measurement <ACP> F2

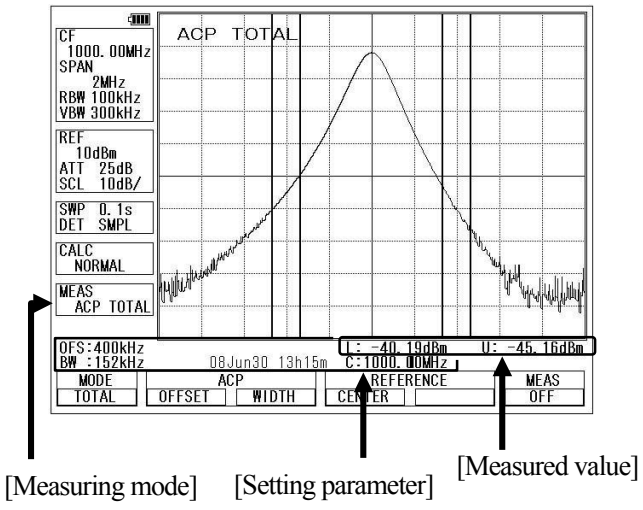
The adjacent channel leakage power is measured as the ratio of power in the range specified by offset frequency and bandwidth to carrier power. Both of leakage power at the upper and lower side are measured. Furthermore, the method for measurement is selected out of three methods based on the classification of definition of carrier power; total power method, reference level method and in-band method.

●Mode selection and measurement

[By pushing F1 (MODE), TOTAL, BAND or PEAK mode is selected.]

* "ACP TOTAL", "ACP BAND" or "ACP PK" is displayed in MEAS area on the screen.

* The measured value and the setting parameter are displayed at the lower on the screen.



1. By F2 (ACP OFFSET) → ◯ , the offset frequency of adjacent channel is set.

   * The offset is from the center frequency of the reference carrier.

2. By F3 (ACP WIDTH) → ◯ , the band width of adjacent channel is set.

3. By F4 (REFERENCE CENTER) → ◯ , the center frequency of the reference carrier is set.

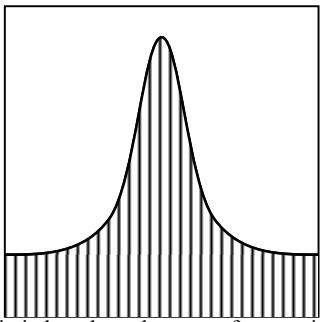
   * [F4] is only for TOTAL and BAND mode.

4. By F5 (REFERENCE WIDTH) → ◯ , the band width of reference carrier is set.

   * [F5] is only for BAND mode.

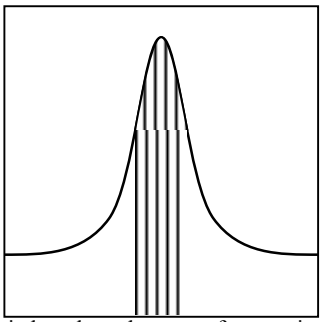
●Definition of reference carrier for each mode

TOTAL (total power method)



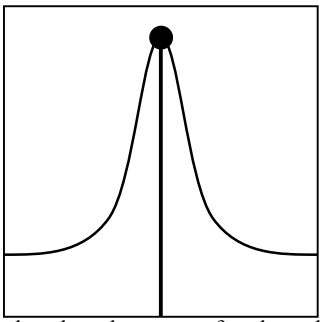
This is based on the sum of power in the displayed spectrum. The center frequency of the reference carrier is set by [F4].

BAND (in-band method)



This is based on the sum of power in the specified bandwidth. The center frequency of the reference carrier is set by [F4].

PEAK (reference level method)



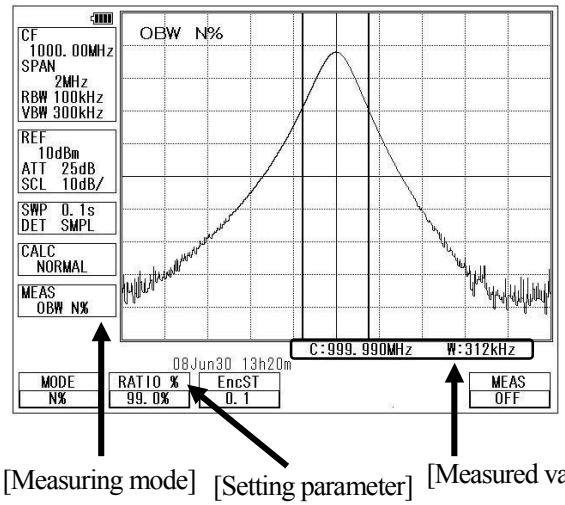
This is based on the power of peak on the screen. The center frequency of the reference carrier is automatically set to the peak on the screen.

19.3 Occupied bandwidth measurement <OBW> F3

It is possible to measure the occupied frequency bandwidth defined as the width of points at N(%) of the total power (N% POWER), or as the width of points that are X(dB) lower than the peak level (XdB DOWN).

●N% POWER mode [By pushing F1 (MODE), N% POWER mode (N%) is selected.]

The bandwidth of points at N(%) of the total power is measured.



* "OBW N%" is displayed in MEAS area on the screen.
* The measured value is displayed at the lower right corner on the screen.

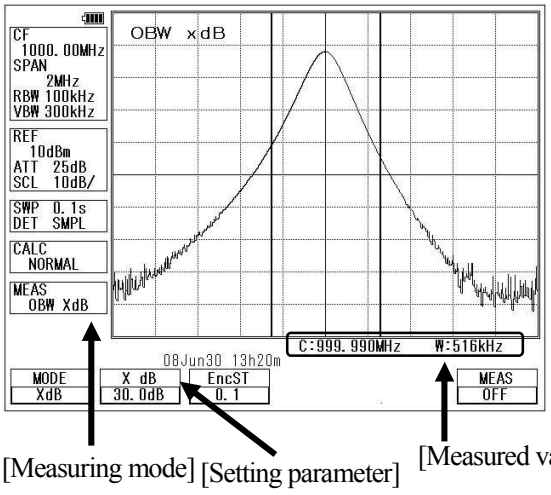
1. By F2 (RATIO %) → ◯, the percentage of the total power is set.

* Setting range : 80.0 to 99.9%

2. By F3 , the step size of RATIO % can be set to 1% or 0.1%.

●XdB DOWN mode [By pushing F1 (MODE), XdB DOWN mode (X dB) is selected.]

The bandwidth of points that are X(dB) lower than the peak level is measured.



* "OBW XdB" is displayed in MEAS area on the screen.
* The measured value is displayed at the lower right corner on the screen.

1. By F2 (XdB) → ◯, the down level from the peak level is set.

* Setting range : 0.1 to 80.0dB

2. By F3 , the step size of XdB can be set to 1dB or 0.1dB.

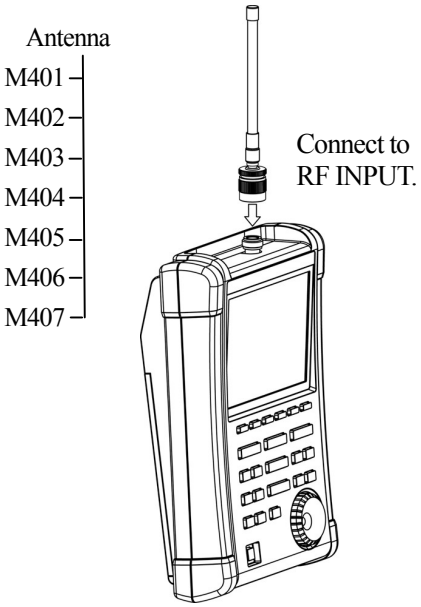
19.4 Electric field strength measurement <E/F ANT> F4

Connecting a dipole antenna (option) to the RF input enables the measurement of the electric field strength.

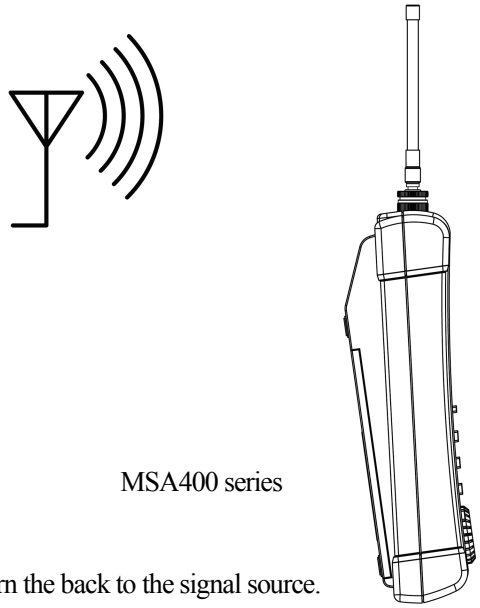
Other than the optional antenna is also available by creating the original compensation data.

(Refer to "25.8 Writing of original compensation data" for the details.)

[Antenna connection]



[Measurement environment]



[Specifications of dipole antenna (The antenna gain and VSWR are specified at the center of frequency range.)]

Items	M401	M402	M403	M404	M405	M406	M407
Type	Sleeve	Sleeve	Sleeve	Sleeve	1/4 λ whip	Sleeve	1/4 λ whip
Frequency range	0.8 to 1GHz	1.25 to 1.65GHz	1.7 to 2.2GHz	2.25 to 2.65GHz	300 to 500MHz	4.7 to 6.2GHz	470 to 770MHz
Antenna gain	＞1dBi	＞1dBi	＞1dBi	＞1dBi	＞1dBi	＞1dBi	＞1dBi
VSWR	＜1.5	＜1.5	＜1.8	＜1.8	＜1.5	＜1.8	＜1.5
Dimensions	7.5φ×280mm	7.5φ×280mm	7.5φ×210mm	7.5φ×210mm	8.0φ×212mm	7.5φ×152mm	8.0φ×138mm
Weight	Approx. 58g	Approx. 60g	Approx. 58g	Approx. 56g	Approx. 62g	Approx. 54g	Approx. 56g
Reference level setting range (except for the minimum value in screen shift)	93 to 143 dBμV/m	96 to 146 dBμV/m	98 to 148 dBμV/m	100 to 150 dBμV/m	87 to 137 dBμV/m	109 to 159 dBμV/m	91 to 141 dBμV/m

* When M405 ,M407 is used, the measurement errors will occur due to how to hold of instrument and influence of human body, because M405 ,M407 is 1/4 λ whip antenna. The error value will be several dB or more. In order to reduce the error, separate MSA400 series from human body as much as possible.

●Mode selection and measurement

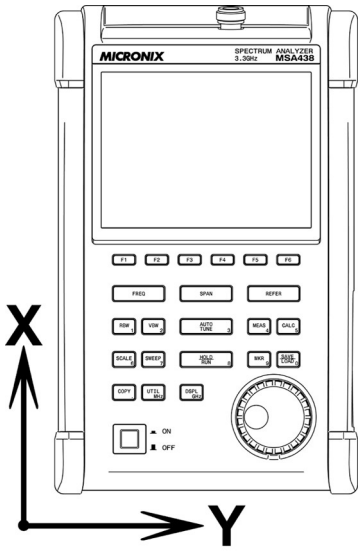
By pushing [F1] (ANT), the antenna (M401/M402/M403/M404/M405/M406/M407/USER) can be selected. The measurement starts as soon as the antenna is selected.

* "E/F M40X" or "E/F USER" is displayed in MEAS area on the screen.
* "USER" is the original compensation data which is created by the user.
  (Refer to "25.8 Writing of original compensation data" for the details.)
* The spectrum may exceed the area on the screen depending on the antenna gain compensation.

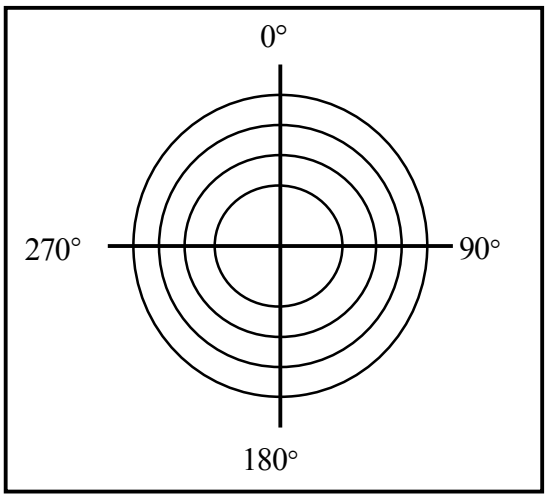
The unit of amplitude axis automatically changes into [dBμV/m].

* The optimum center frequency and frequency span are automatically set according to the antenna.
  In addition, a spectrum other than the frequency range of the antenna is not displayed.

●Directivity of antenna (reference data)

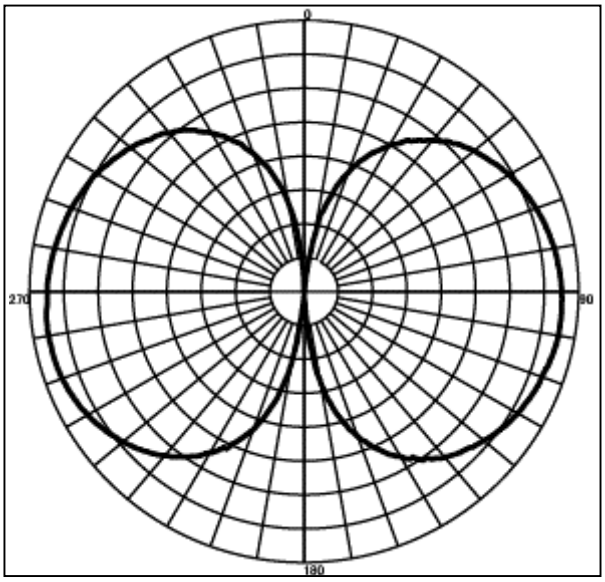


E plane : X-Y axis (X direction=0°)

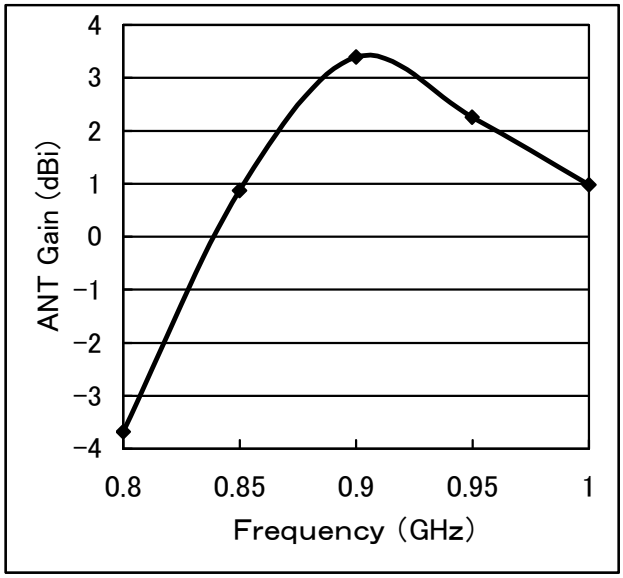


* The following are the data when the antenna is connected to RF input directly with no obstacles around.
  Actually, the directivity changes due to the human body when handling the unit.
* However, the data of M405 is the reference data which is included the influence of the human body.

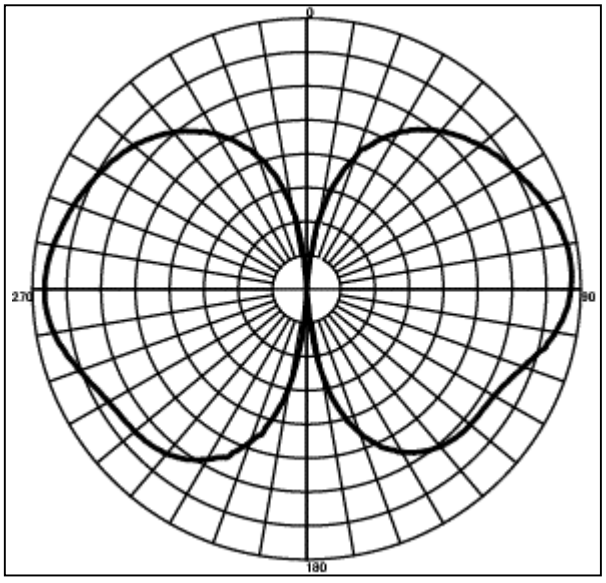
M401 (900MHz, E plane)



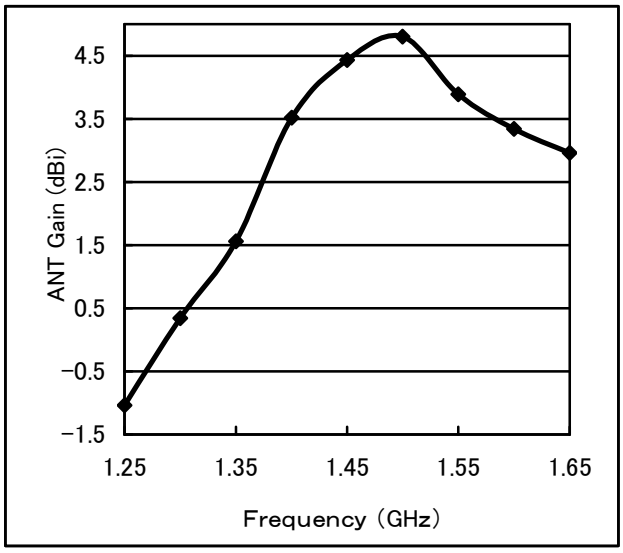
Antenna gain vs. Frequency



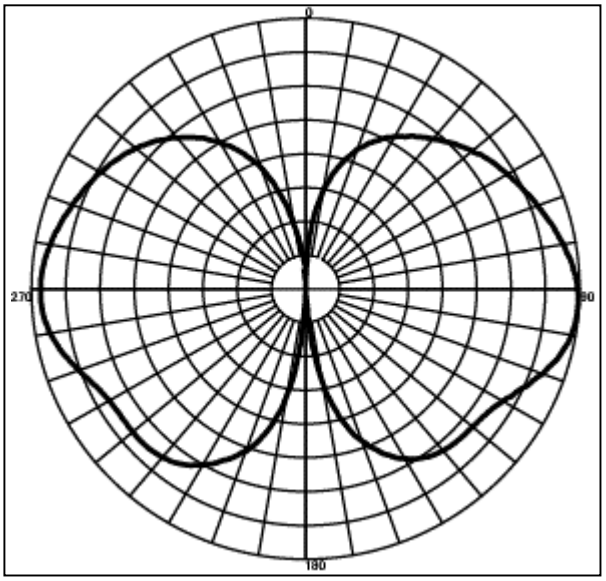
M402 (1.5GHz, E plane)



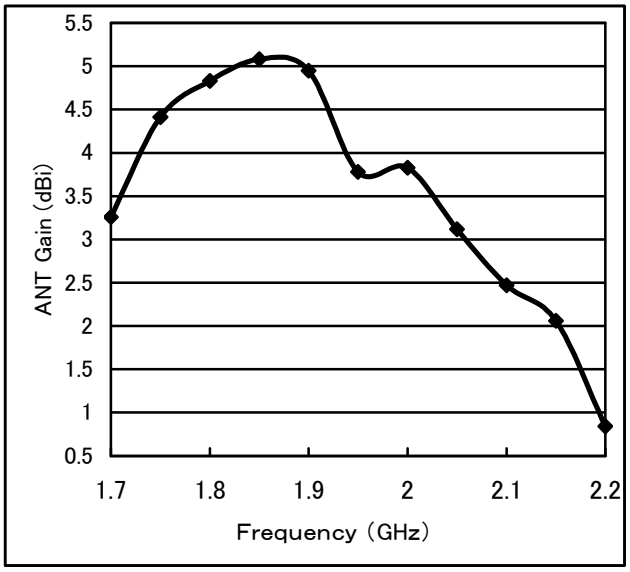
Antenna gain vs. Frequency



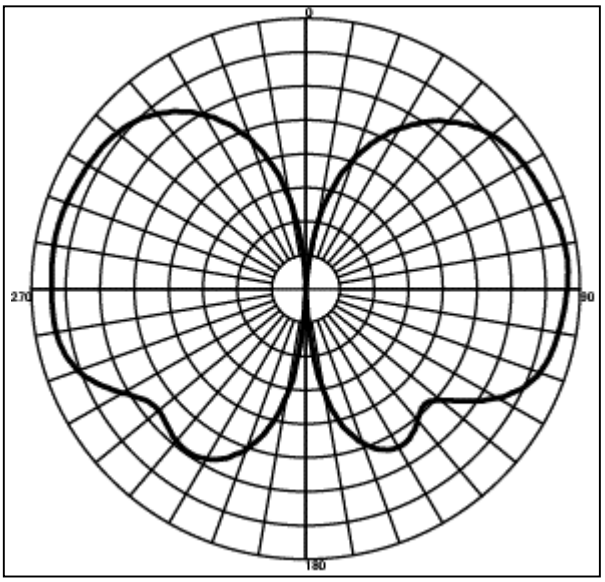
M403 (2GHz, E plane)



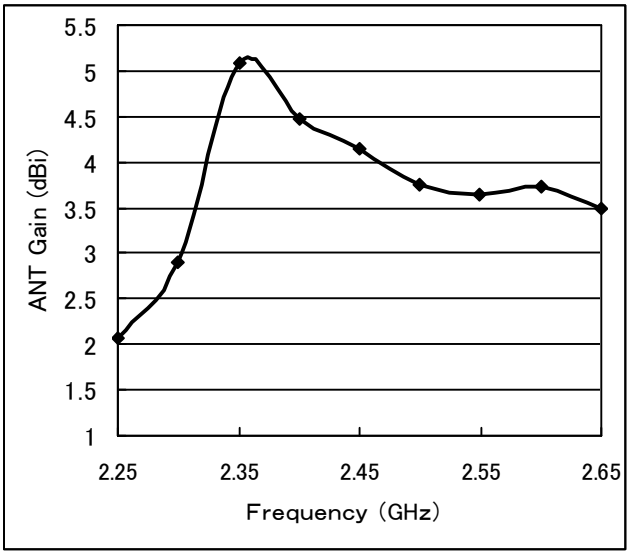
Antenna gain vs. Frequency



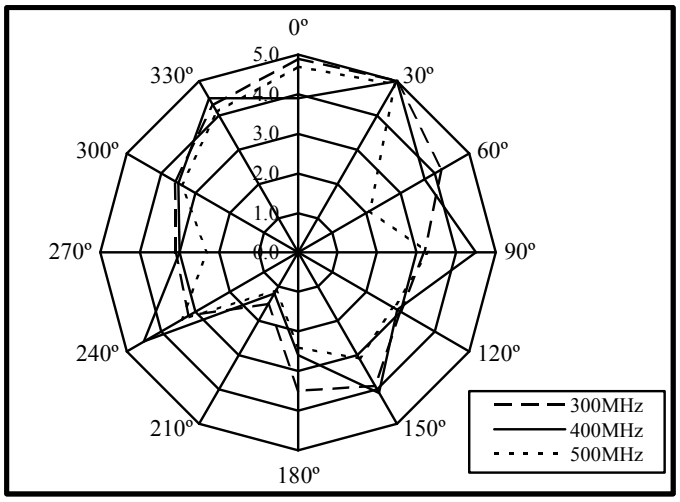
M404 (2.4GHz, E plane)



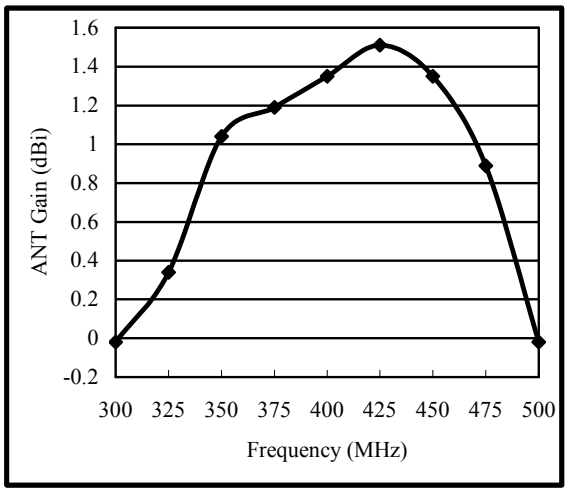
Antenna gain vs. Frequency



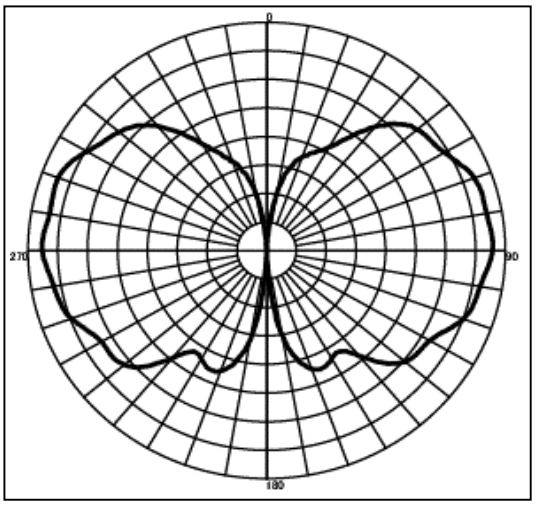
M405 (horizontal plane)



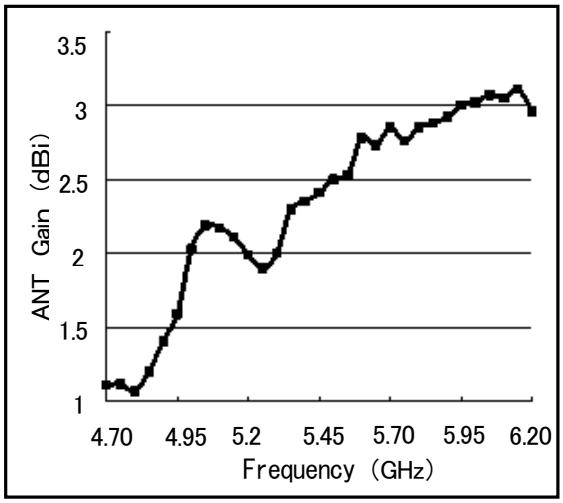
Antenna gain vs. Frequency



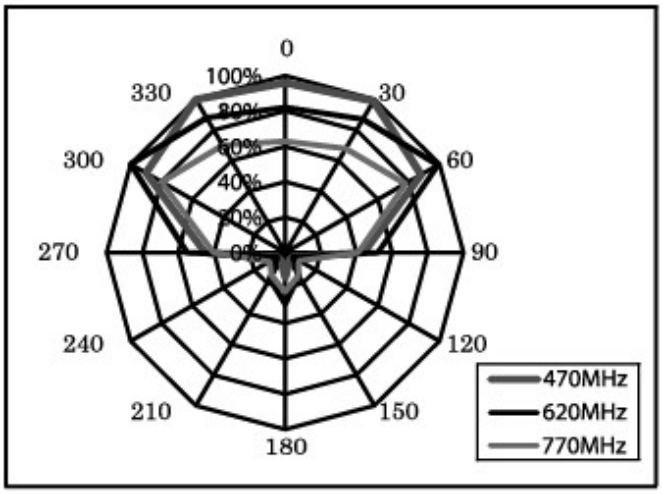
M406 (5.4GHz, E plane)



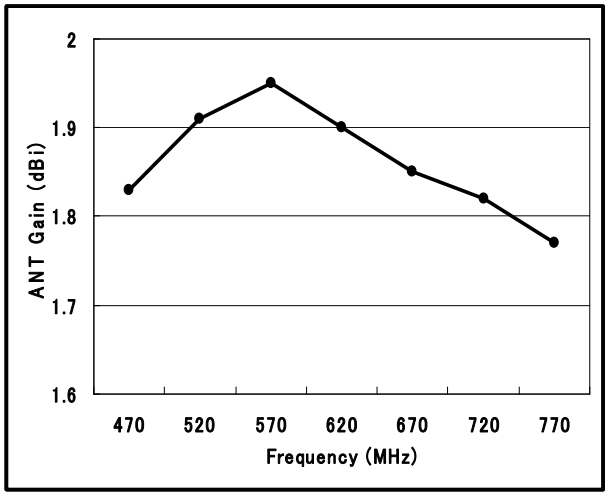
Antenna gain vs. Frequency



M405 (horizontal plane)



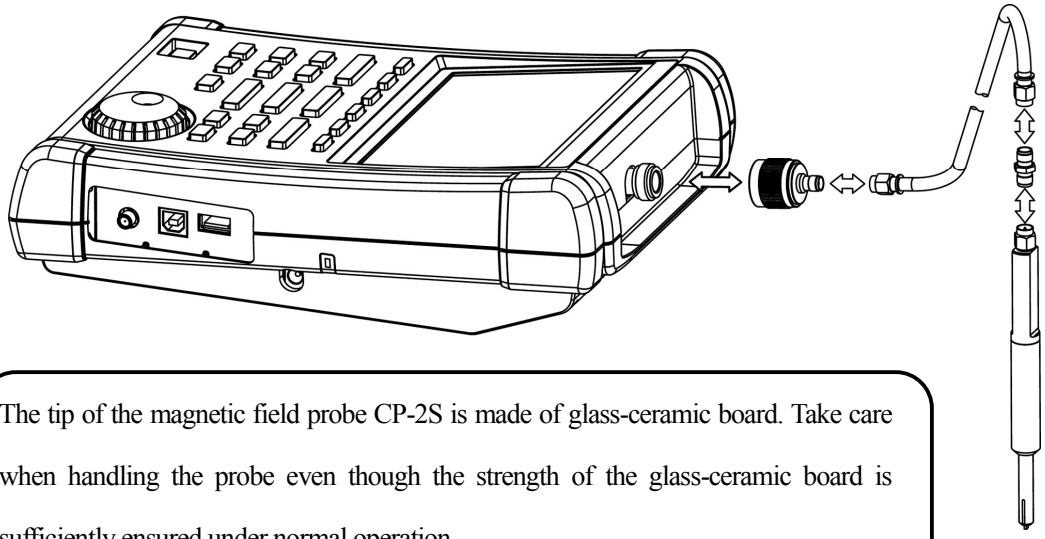
Antenna gain vs. Frequency



19.5 Magnetic field strength measurement <M/F PROBE> F5

The magnetic field distribution can be measured by using the magnetic field probe CP-2S (option).

[Magnetic field probe connection]



The tip of the magnetic field probe CP-2S is made of glass-ceramic board. Take care when handling the probe even though the strength of the glass-ceramic board is sufficiently ensured under normal operation.

"Specifications of magnetic field probe CP-2S" (Refer to the operating manual for CP-2S for the details.)

Item	Specifications
Frequency range	10MHz to 3GHz
Space resolution (-6dB)	approx. 0.25mm (depending on objects)
Reference level setting range: maximum	160 to 203dBμA/m
Reference level setting range: minimum (except for the minimum value in screen shift)	110 to 153dBμA/m
Measurement error	approx.±1dB (probe simple substance)

●Mode selection and measurement

By pushing F1 (PROBE), CP-2S or USER mode is selected.

The measurement starts as soon as the probe is selected.

* "M/F CP2S" or "M/F USER" is displayed in MEAS area on the screen.
* "USER" is the original compensation data which is created by the user.
  (Refer to "25.8 Writing of original compensation data" for the details.)

The unit of amplitude axis is automatically changes into [dBμA/m].

* A spectrum other than the frequency range of the probe is not displayed.

19.6 Frequency counter <FREQ COUNT> (factory option) F6

The frequency counter enables you to measure the frequency of input signal more accurately.

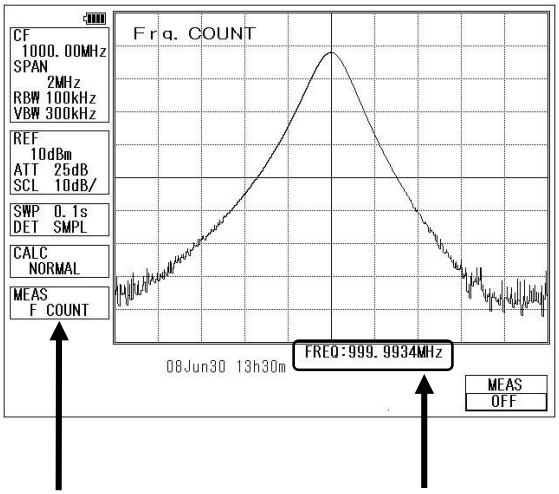
Set reference level so that the input signal level is displayed between reference level and (Reference level - approx.30dB).

"Specifications of frequency counter"

Item	Specifications
Frequency range	1MHz to 3.3GHz (MSA438/E/TG) / 1MHz to 8.5GHz (MSA458)
Measured level	+10 to –70dBm @ 1MHz to 2GHz, RBW 100kHz +10 to -60dBm @ 2GHz to 3.3GHz, RBW 100kHz
Measurement resolution	100Hz
Display digits	8 digits max.
Reference x'tal	Accuracy: ±2ppm @ 23℃, Temp. characteristic: ±5ppm @ 0 to 40℃

* The setting range of sweep time is 0.1s or more.
* It does not correspond to FULL SPAN.

●Measurement



[Measuring mode] [Measured value]

By pushing F6, FREQ COUNT mode is set.

* "F COUNT" is displayed in MEAS area on the screen.

Set the spectrum roughly to be at the center on the screen, and then the frequency of input signal is measured.

The measured value is displayed at the lower on the screen.

* If the level of spectrum is unmeasurable, for example is too small, "Non Signal" is displayed on the screen.
* If the frequency counter (factory option) is not installed, "Invalid for F/C" is displayed on the screen.

20. EMI Test (MSA438E)

20.1 Additional function for EMI test

● Detection mode（Refer to "13. Setting the Detection mode"）

By pushing **SWEEP** → **F4**, the detection mode can be set.

POS → SMPL → NEG → QP → AV

In MSA438E, QP detection and AV detection are added for EMI measurement.

POS (Positive Peak)	: The spectrum of the maximum value between the sample points
SMPL (Sample)	: The spectrum of the momentary value between the sample points
NEG (Negative Peak)	: The spectrum of the minimum value between the sample points
QP (Quasi Peak)	: The spectrum of the quasi peak value between the sample points
AV (Average)	: The spectrum of the average value between the sample points

As for QP detection, the following characteristics are chosen according to the setting of RBW.

(based on CISPR16)

RBW	charging time constant	dis-charging time constant	meter time constant
9kHz	1ms	160ms	160ms
120kHz	1ms	550ms	100ms

● Preset (Initialization) (Refer to "18. Save/Load")

In MSA438E, the radiated emission measurement and the conducted emission measurement are added to the preset as a default setting.

By pushing **SAVE/LOAD** → **F6**, the menu is displayed

F1 NORMAL : The initial parameters of normal mode are set.

F2 EMI-C : The initial parameters of conducted emission measurement are set.

F3 EMI-R : The initial parameters of radiated emission measurement are set

In the radiated mission measurement, "USER" is selected as an antenna.

It is necessary to input the compensation data of antenna beforehand.

20.2 EMI test

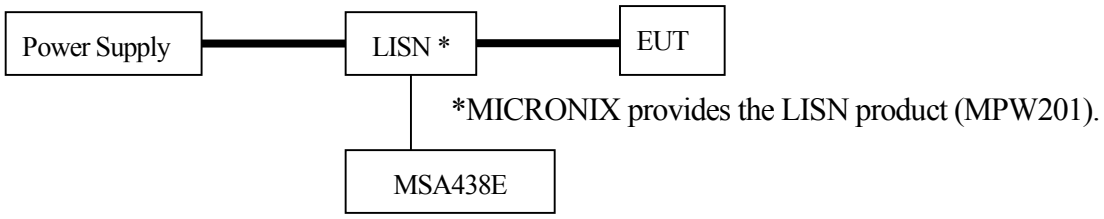
The QP detection is usually used in both of the radiated and conducted emission measurements, and the AV detection is usually used in the conducted emission measurement. The measurement time can be shortened by using them in the final measurement to the spectrums narrowed by the PK detection.

● Conducted emission measurement

The conducted emission discharged through the power supply line is measured.

In this measurement, LISN* (Line Impedance Stabilization Network) device is needed.

The connection is shown in the figure below. Please refer to the manual of LISN for details of the connection and notes.

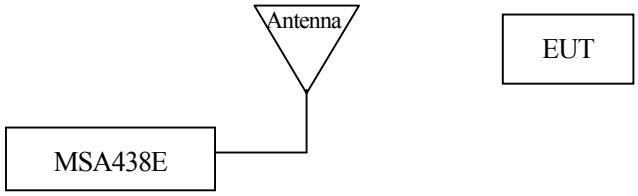


1. Turn on the power of MSA438E after the connection.
2. Set the initial parameters of conducted emission measurement by pushing **SAVE/LOAD** → **F6** → **F2** . The setting parameters are as follows.

   Center Frequency : 25.5MHz
   Frequency span : 50MHz
   RBW : 9kHz
   VBW : 1MHz
   Sweep time : 3sec
   Detection mode : Positive peak mode
3. Confirm whether the connection and the operation are correct by supplying the power to the EUT and measuring.
4. Set the number of times of the sweep in the MAX HOLD mode by operating **CALC** → **F2** → ◎.
5. Search the frequency of disturbance noise that exceeds the AV or QP limits by using the marker function.
6. Set the center frequency to the point that exceeds the limits, the SPAN to 2MHz and the SWEEP to 0.1sec. And measure the frequency accurately.
7. Moreover, measure the frequency detected in the above with QP or AV detection, then the SPAN is 200kHz and the SWEEP is 10sec.

● Radiated emission measurement

The electric field strength of disturbance noise that EUT radiates in the air is measured.



1. Set the compensation data of the antenna beforehand.
   Refer to " 25.8 Writing original compensation data" for the details.
2. Turn on the power of MSA438E after connection.
3. Set the initial parameters of radiated emission measurement by pushing **SAVE/LOAD** → **F6** → **F3** . The setting parameters are as follows.

Center Frequency	: 515MHz
Frequency span	: 1GHz
RBW	: 120kHz
VBW	: 1MHz
Sweep time	: 0.3sec
Detection mode	: Positive peak mode

4. Confirm whether the connection and the operation are correct by supplying the power to the EUT and measuring.
5. Set the number of times of the sweep in the MAX HOLD mode by operating **CALC** → **F2** → ◎.
6. Search the frequency of disturbance noise that exceeds the QP limits by using the marker function.
7. Set the center frequency to the point that exceeds the limits, the SPAN to 50MHz and the SWEEP to 30msec. And measure the frequency accurately.
8. Moreover, measure the frequency detected in the above with QP detection, then the SPAN is 1MHz and the SWEEP is 30sec.

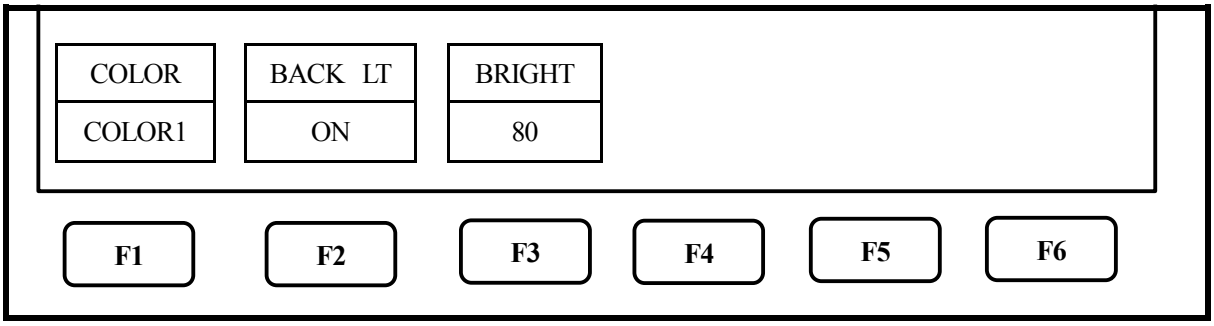
EMI standards (selected) (As of June 2008)

	Frequency	Quasi Peak	Average	
CISPR22 class A Limits of conducted disturbance at mains ports	0.15MHz to 0.50MHz 0.50MHz to 30MHz	79dBuV 73dBuV		
CISPR22 class B Limits of conducted disturbance at mains ports	0.15MHz to 0.50MHz 0.50MHz to 5MHz 5MHz to 30MHz	66 to 56dBuV 56dBuV 60dBuV	56 to 46dBuV 46dBuV 50dBuV	Decreasing linearly with the logarithm of the frequency
CISPR22 class A Limits of radiated disturbance	30MHz to 230MHz 230MHz to 1000MHz	40dBuV/m 47dBuV/m	--- ---	Measurement distance 10 m
	1000MHz to 3000MHz 3000MHz to 6000MHz	76dBuV/m 80dBuV/m	56dBuV/m 60dBuV/m	Measurement distance 3 m
CISPR22 class B Limits of radiated disturbance	30MHz to 230MHz 230MHz to 1000MHz	30dBuV/m 37dBuV/m	--- ---	Measurement distance 10 m
	1000MHz to 3000MHz 3000MHz to 6000MHz	70dBuV/m 74dBuV/m	50dBuV/m 54dBuV/m	Measurement distance 3 m
VCCI class A Limits of conducted disturbance at mains ports	0.15MHz to 0.50MHz 0.50MHz to 30MHz	79dBuV 73dBuV	66dBuV 60dBuV	
VCCI class B Limits of conducted disturbance at mains ports	0.15MHz to 0.50MHz 0.50MHz to 5MHz 5MHz to 30MHz	66 to 56dBuV 56dBuV 60dBuV	56 to 46dBuV 46dBuV 50dBuV	Decreasing linearly with the logarithm of the frequency.
VCCI class A Limits of radiated disturbance	30MHz to 230MHz 230MHz to 1000MHz	40dBuV/m 47dBuV/m	--- ---	Measurement distance 10 m
	1000MHz to 3000MHz 3000MHz to 6000MHz	76dBuV/m 80dBuV/m	56dBuV/m 60dBuV/m	Measurement distance 3 m
VCCI class B Limits of radiated disturbance	30MHz ～ 230MHz 230MHz ～ 1000MHz	30dBuV/m 37dBuV/m	--- ---	Measurement distance 10 m
	1000MHz to 3000MHz 3000MHz to 6000MHz	70dBuV/m 74dBuV/m	50dBuV/m 54dBuV/m	Measurement distance 3 m
FCC part15 subpartB class A Limits of conducted disturbance at mains ports	0.15MHz to 0.50MHz 0.50MHz to 30MHz	79dBuV 73dBuV	66dBuV 60dBuV	
FCC part15 subpartB class B Limits of conducted disturbance at mains ports	0.15MHz to 0.50MHz 0.50MHz to 5MHz 5MHz to 30MHz	66 to 56dBuV 56dBuV 60dBuV	56 to 46dBuV 46dBuV 50dBuV	Decreasing linearly with the logarithm of the frequency.
FCC part15 subpartB class A Limits of radiated disturbance	30MHz to 88MHz 88MHz to 216MHz 216MHz to 960MHz over 960MHz	39.1dBuV/m 43.5dBuV/m 46.4dBuV/m 49.5dBuV/m	--- --- --- ---	Measurement distance 10 m
FCC part15 subpartB class B Limits of radiated disturbance	30MHz to 88MHz 88MHz to 216MHz 216MHz to 960MHz over 960MHz	40dBuV/m 43.5dBuV/m 46dBuV/m 54dBuV/m	--- --- --- ---	Measurement distance 3 m

(Attention) This table is a background information. Micronix is not liable to you for any damages due to the mistake of the content of the description.

21. Screen Control <DSPL>

When [DSPL] is pushed, the following function menu is displayed.



21.1 Setting of color of screen display

When [F1] is pushed, the color of screen display can be selected.

COLOR1 → COLOR2 → MONO

- COLOR1 : For normal use
- COLOR2 : For print of screen
- MONO : Monochrome

21.2 ON/OFF switching of LCD backlight

When [F2] is pushed , the LCD backlight is alternately switched to ON or OFF.

21.3 Adjustment of brightness of LCD backlight

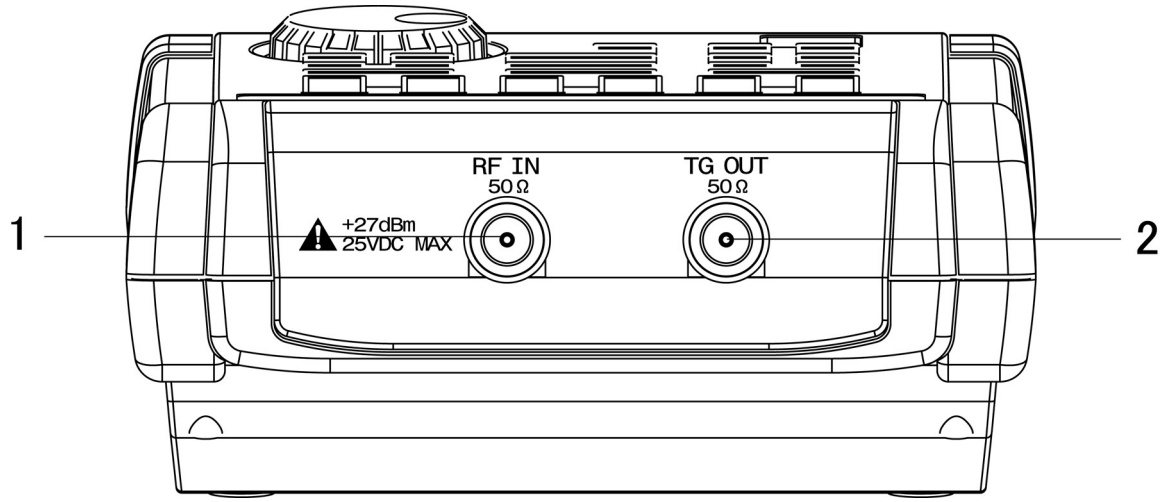
Use [F3] → ◯ to set the brightness. It can be set in 100 steps.

22. Tracking Generator Mode (MSA438TG)

22.1 Specification of T.G. function

Item	Specification
Frequency range	5MHz to 3.3GHz
Output Level	-10dBm±1dB @1GHz(Fixed value)
Output flatness	±1.5dB
Output impedance	50Ω
Output VSWR	Less than 2.0
Output connector	N(J) connector

22.2 Description of I/O connector



1) Input connector

N (J) connector

Input for an external signal

Make sure that the total power of input signals does not exceed +27dBm.

2) Output connector

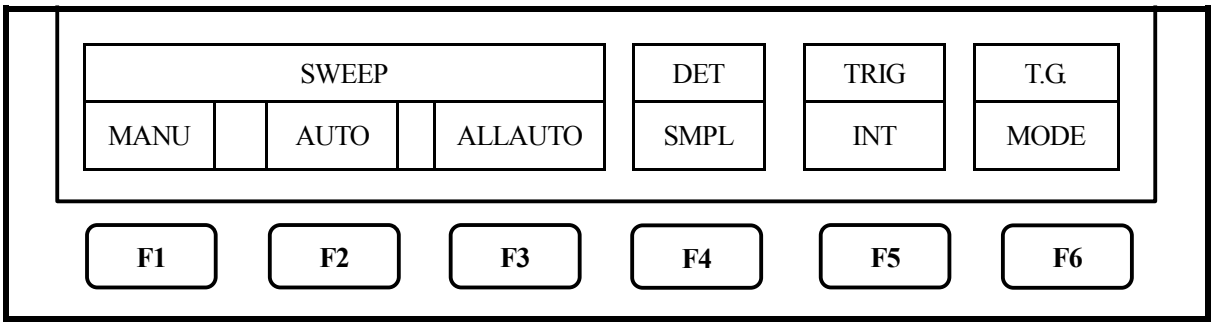
N (J) connector

It is an output terminal of Tracking Generator.

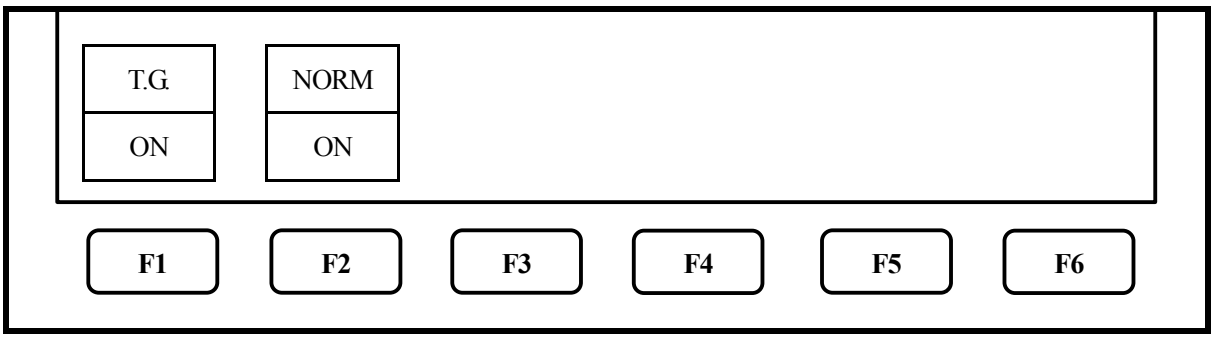
※ **Please set to "TG:OFF" to prevent the influence of the leak from the Tracking Generator in case of disuse of the T.G. function..**

22.3 ON/OFF Switching of TG function

When **SWEEP** is pushed, the following function menu is displayed.



1. When **F6** is pushed, TG. MODE is set.



2. Each time **F1** is pushed, TG. output is alternately switched to ON or OFF.

22.4 Normalizing function

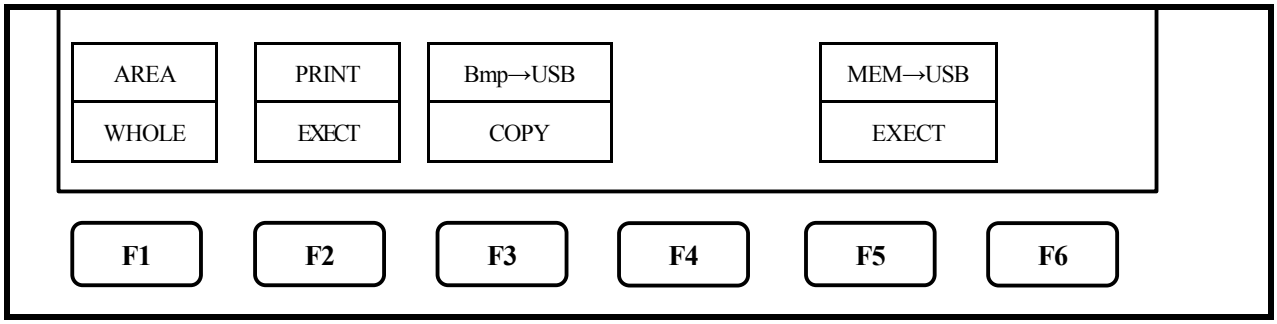
NORM ON : The input level is made flat to the red line on the screen.

1. When **SWEEP** is pushed, the same function menu as the previous item is displayed.
2. When **F6** is pushed, TG. MODE is set.
3. Each time **F2** is pushed, the normalizing function is alternately switched to ON or OFF.
   If the normalizing function is switched to ON, "NORM ON" is displayed on the screen.

* If the setting is changed as follows, the normalizing function is automatically turned off.
  ・The span is expanded. ・The center frequency is changed beyond the range normalized.
  (When SPAN is changed from FULL SPAN according to center frequency, it is turned off.)
  ・The magnetic field strength measurement or the frequency counter (factory option) is selected.
  ・The AUTO tuning is executed. ・The power supply is turned off. ・The presetting is executed.
* When the scale is 2dB or 5dB, the normalizing function does not operate correctly if the spectrum level is not displayed at a proper position on the screen.

23. Storage and print of screen image <COPY>

The following function menu is displayed when **COPY** is pushed.



23.1 Selection of image area

When **F1** is pushed, the image area to be stored or printed can be selected.

WHOLE : the whole screen image is stored or printed.

SPECT : only the spectrum display area is stored or printed.

23.2 Print on printer

When pushing **F2** after connecting the printer (option), the area selected in 24.1 is printed.

23.3 Storage into USB memory

When pushing **F3** after connecting USB memory (user's) to this unit, the area selected in 24.1 is stored in USB memory by BMP (bit map) format. As for the file name, the number is automatically put such as "MSA001.bmp". In case that some characters is written in the label area, the file name cosists of it and the number put automatically such as "LABEL001.bmp". The folder "MSAIMG" is automatically generated and these files are recorded there.

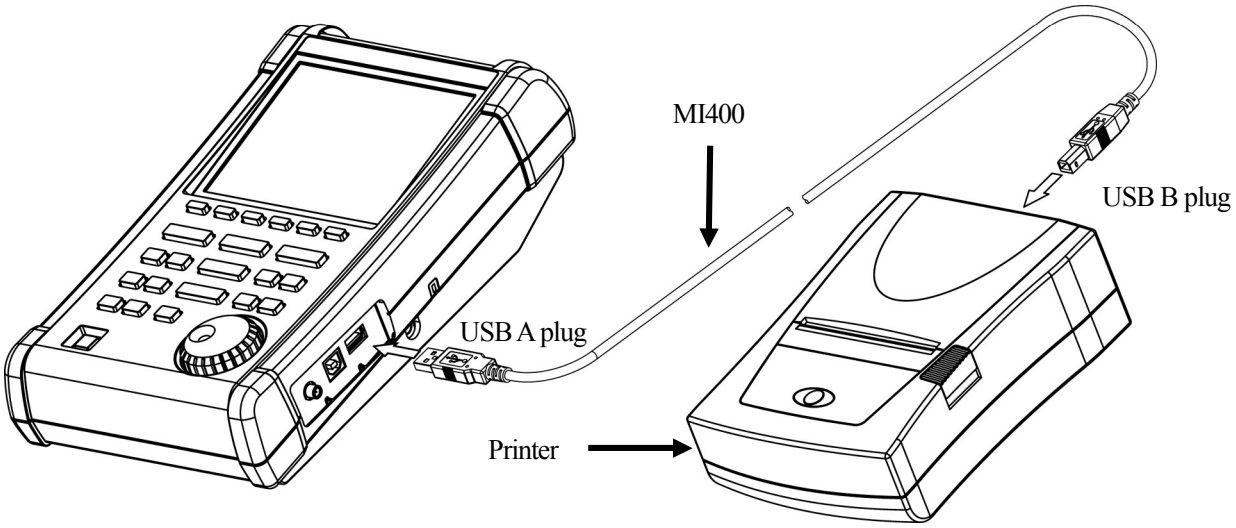
As for setting such as color or monochrome display, refer to "21.Display control".

23.4 Transferring internal data to USB memory in a lump sum

When pushing **F5** after connecting USB memory (user's) to this unit, the data stored in the internal memory with SAVE/LOAD function are transferred to USB memory in a lump sum. The folder "MSASVLDI" is automatically generated and these files are recorded there.

23.5 USB printer (option)

The MSA400 series enables a hard copy of the screen by connecting USB printer (option) to USB A plug with USB cable MI400 (option).



* Turn on the power of the MSA400 series unit first. After that, turn on the power of USB printer. Otherwise, it doesn't work normally.

23.6 USB memory

USB memory can be used as a removable storage.

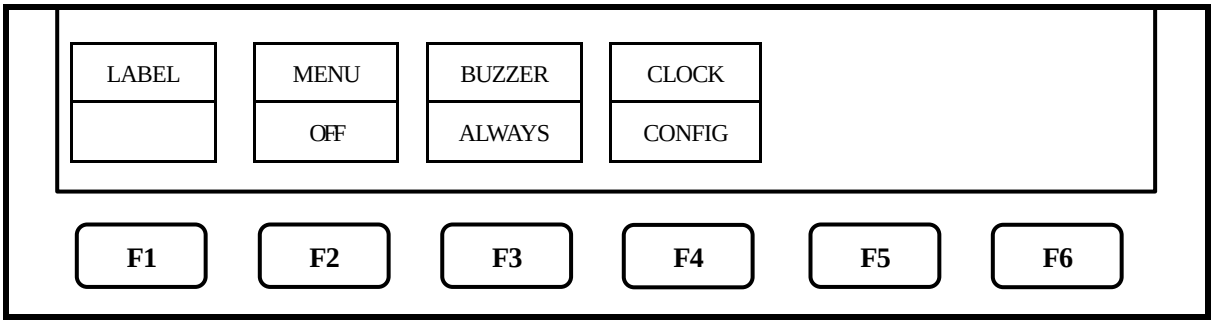
※ If the USB memory is installed again after it is installed once and then removed, the MSA400 series cannot normally recognize it. In that case refer to the following operation.

Method of recognition:

By the operation of [SAVE／LOAD] → [F5], the USB memory is recognized.

24. Utility Function <UTIL>

When **UTIL** is pushed, the following function menu is displayed.



● The subsidiary function is selected.

F1 Label function : The specified characters are written in the label display area (MAX 16 characters).

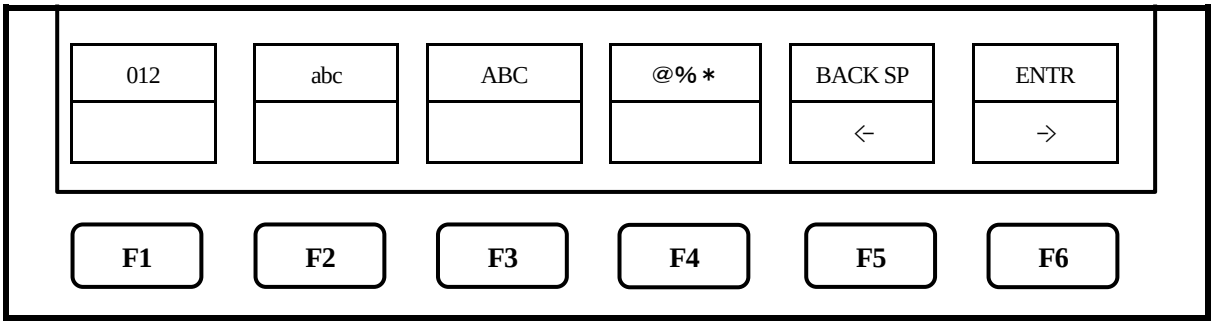
F2 Menu off : The display of function menu and active area is erased.

F3 Buzzer setting : The condition on which a buzzer is sounded is set.

F4 Clock function setting : The built-in clock is set.

24.1 Label function

When **UTIL** → **F1** is pushed, the following function menu is displayed.



1. The kind of character to be written is selected with **F1** to **F4** .

F1 012 : 0 to 9 (numeral)

F2 abc : a to z (small letter alphabet)

F3 ABC : A to Z (capital letter alphabet)

F4 @%* : ! " # % &' ( ) + - . / : ; <=>? @ [¥] ^_ (mark)

2. One character in the label display area becomes reverse display.

By rotating  , one reversed character is replaced with a numeral, a small letter alphabet, a capital letter alphabet or a mark.

3. When **F6** is pushed, the reversed part moves right by one character. And the previous character is decided.

4. When **F5** is pushed, the reversed part moves left by one character. The previous part becomes a space.

And the character can be deleted one after another by consecutively pushing this key.

5. The position where the character is input can be decided by moving the reversed part right and left with **F5** and **F6**.

And after then, if either of keys from **F1** to **F4** is pushed, the character can be input in the reversed part.

24.2 Menu off

By pushing **F2**, the display of the function menu and the active area can be erased temporarily. After then, they are displayed as usual the moment any other keys excepting **F1** to **F6** are pushed.

24.3 Buzzer setting

By pushing **F3**, the condition of the buzzer sound at the operation of the key and the rotary encoder can be set.

whenever this key is pushed, the following three conditions are displayed one by one, and one of those can be selected.

OFF : The buzzer is not sounded.

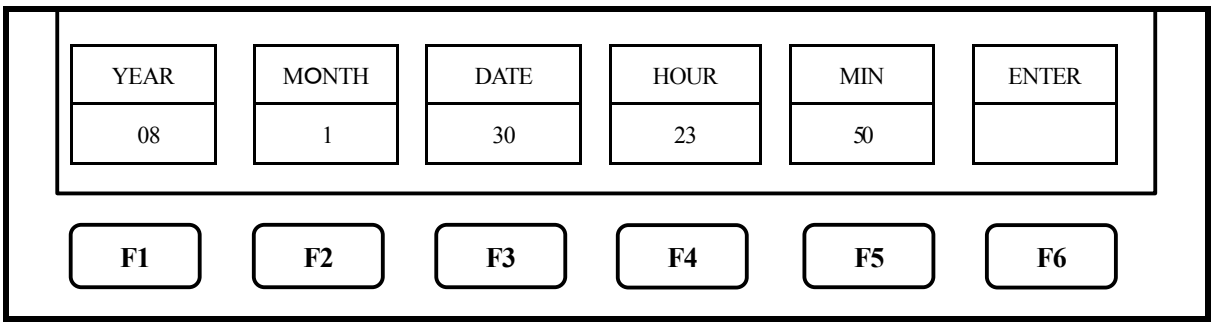
ALARM : The buzzer is sounded in an incorrect setting for a warning and is not sounded in a correct setting.

ALWAYS : The buzzer is sounded whenever a key or the rotary encoder is operated.

※ When the battery voltage becomes low at the battery operation, the buzzer is sounded. (Even if OFF is selected, it is sounded.)

24.4 Setting of clock

When **UTIL** → **F4** is pushed, the following function menu is displayed.



The year, month, day and time are displayed below the screen. (Refer to "4. Explanation of screen")
Set the year, month, day and time when MSA400 series is used for the first time.
The time information is updated even if the power is turned off after then.

1. By rotating ◯, the value of the menu which is selected by the key from **F1** to **F4** changes and is displayed by the numeral or / in the lower of each menu.
2. **F1** The year is input. Two last digits at the Christian era are displayed. It is possible to set them within the range from 00 to 99.
   F2 The month is input.
   F3 The day is input.
   F4 The hour is input. It is displayed by twenty-four hour notation.
   F5 The minute is input.
3. By pushing **F6**, the values which are input in item 2. are decided. The values are not updated if this key is not pushed.

※ The clock function of MSA400 series is driven with a dedicated LSI, and the power is supplied by a built-in lithium battery.

25. USB device Function

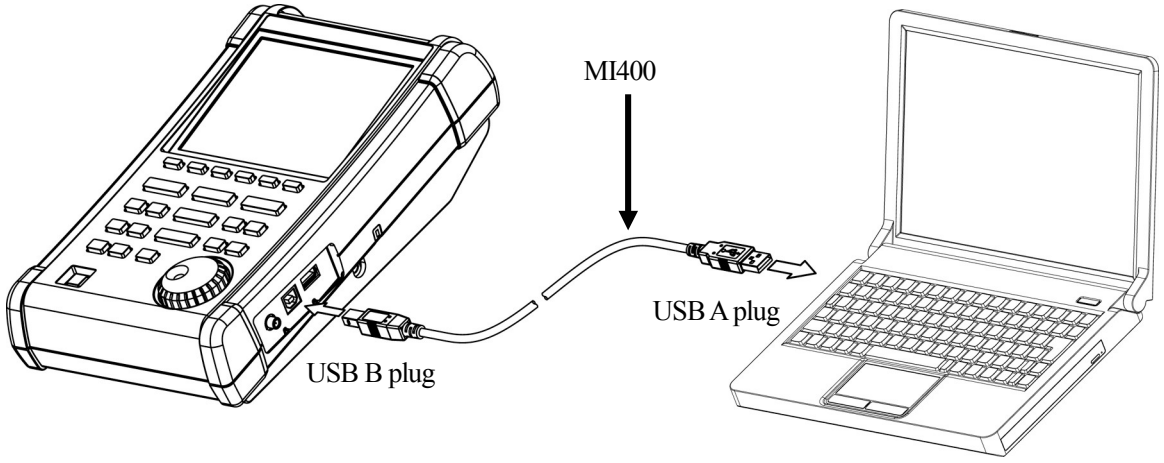
25.1 Outline

The MSA400 series is equipped with two kinds of USB connecters of A and B plugs. The A plug is for USB host and is connected to USB devices such as USB memory and printer. On the other hand, the B plug is for USB device and is connected to USB host such as a personal computer. The device function is explained in this chapter.

As for the host function using USB A plug, refer to "23. Storage and printer of screen image".

25.2 How to connect

When you use USB interface, connect with USB cable MI400 (option) as follows.



25.3 Installation of driver

The specified driver is necessary in order to control the MSA400 series with a PC through USB interface, and should be installed in the PC to be used in advance.

As for the installation of the driver, first of all, the USB driver is downloaded. Download it from "DOWNLOAD" site in our website.

Download the file for USB driver "MnixUsb_WIN2K.zip" on the following download site.

http://www.micronix-jp.com/Products/download/download.html

Next, unzip the Zip file.

After the downloaded file is unzipped, the MSA400 series is connected to a PC with the USB cable and then the power is turned on. The detection wizard for the USB driver starts on the PC screen the moment the power of the MSA400 series is turned on, and install it following this wizard.

25.4 Sample program

The sample program can be downloaded from "DOWNLOAD" site in our website same as the USB driver. Refer to Sample.txt.

25.5 Explanation of Command

* "CR(0D[HEX])+LF(0A[HEX])" is added to the end of every command. When the command is sent from PC, MSA438 (E/TG) and MSA458 return some responses, which include "OK" + CR + LF, "ERR" + CR + LF and "(response to command)" + CR + LF.
* By inputting "?" instead of "＊＊" for each command, the current setting parameters are responded. (Except for " ---- Request" command and the command for inputting corrected data.)

1) Setting of center frequency

Command : FREQ＊＊＊＊＊＊＊

（＊＊＊＊＊＊＊: Refer to "25.6 Input of frequency"）

2) Request of set marker

Command : FREQSETMK

* The center frequency is set according to the frequency of current marker position..

3) Setting of frequency span

Command : SPAN＊＊＊＊

MSA438（E/TG）:

(＊＊＊＊＝ZERO, 200K, 500K, 1M, 2M, 5M, 10M, 20M, 50M, 100M, 200M, 500M, 1G, 2G, FULL［unit : Hz])

MSA458 :

(＊＊＊＊＝ZERO, 200K, 500K, 1M, 2M, 5M, 10M, 20M, 50M, 100M, 200M, 500M, 1G, 2G, 5G, FULL［unit : Hz])

4) Setting of reference level

Command : REF＊＊＊

(＊＊＊＝-60 to 10[1 step, unit : dBm])

* When the unit is other than dBm, convert into dBm by using calculating formula in "9.8 Reference level setting range for each unit".

5) Setting of unit of reference level

Command : UNIT＊＊＊

(＊＊＊＝DBM, DBUV, DBMV, DBV)

Command	Unit
DBM	dBm
DBUV	dBμV
DBMV	dBmV
DBV	dBV

6) Setting of RBW

Command : RBW＊＊＊＊

MSA438/438TG/458 :

(＊＊＊＊＝3K, 10K, 30K, 100K, 300K, 1M, 3M, AUTO, ALL［unit : Hz])

MSA438E :

(＊＊＊＊＝3K, 9K, 30K, 120K, 300K, 1M, 3M, AUTO, ALL［unit : Hz])

* ALL : The optimum RBW, VBW and sweep time are set based on the frequency span.
* AUTO : The optimum RBW is set based on the frequency span.

7) Setting of VBW

Command : VBW＊＊＊＊

(＊＊＊＊＝100, 300, 1K, 3K, 10K, 30K, 100K, 300K, 1M, AUTO, ALL［unit : Hz］)

* ALL : The optimum RBW, VBW and sweep time are set based on the frequency span.

* AUTO : The optimum RBW is set based on the frequency span.

8) Start and Stop of measuring function

Command : MEAS＊＊＊

(＊＊＊＊＝CP, ACP, OBW, EF, MF, FC, OFF)

Command	Measuring function
CP	Channel power measurement
ACP	Adjacent channel power measurement
OBW	Occupied bandwidth measurement
EF	Electric field strength measurement
MF	Magnetic field strength measurement
FC	Frequency counter (factory option)
OFF	OFF

9) Request of measuring result

Command : MEASRES

* Example of measuring result

Channel power measurement ----- POW : - 25.5dBm

Adjacent channel power measurement ----- L : - 47.7dBc U : - 48.3dBc

Occupied bandwidth measurement ----- C : 1.45G W : 20.00k

Frequency counter ----- FC : 2400.0000M

* If the frequency counter is not installed, "MEAS OFF" is responded.

* If the level of spectrum is low and unmeasurable, "Non Signal" is responded.

10) Setting of mode for channel power measurement

Command : CPMODE＊＊＊＊＊

(＊＊＊＊＊＝TOTAL, BAND)

Command	Mode
TOTAL	The sum of power on the screen is measured.
BAND	The sum of power in the band specified is measured.

11) Setting of zone center frequency for channel power measurement

Command : CPCNTR＊＊＊＊＊＊＊

(＊＊＊＝0～500 : Screen position, center=250)

12) Setting of zone width for channel power measurement

Command : CPWIDTH＊＊＊＊＊＊＊

(＊＊＊＝0～500 : Screen position, center=250)

13) Setting of mode for adjacent channel power measurement

Command : ACPMODE＊＊＊＊＊

(＊＊＊＊＊＝TOTAL, BAND, PEAK)

Command	Mode
TOTAL	TOTAL (total power method)
BAND	BAND (in-band method)
PEAK	PEAK (reference level method)

14) Setting of band offset for adjacent channel power measurement

Command : ACPOFS＊＊＊＊＊＊＊

(＊＊＊＝0～500 : Screen position, center=250)

15) Setting of bandwidth for adjacent channel power measurement

Command : ACPCHBW＊＊＊＊＊＊＊

(＊＊＊＝0～500 : Screen position, center=250)

16) Setting of reference band center frequency for adjacent channel power measurement

Command : ACPREF＊＊＊＊＊＊＊

(＊＊＊＝0～500 : Screen position, center=250)

17) Setting of reference bandwidth for adjacent channel power measurement

Command : ACPREFBW＊＊＊＊＊＊＊

(＊＊＊＝0～500 : Screen position, center=250)

18) Setting of mode for occupied bandwidth measurement

Command : OBWMODE＊＊

(＊＊: N%/DB)

Command	Mode
N%	N% POWER mode
DB	XdB DOWN mode

19) Setting of N% RATIO for occupied bandwidth measurement

Command : OBWRATIO＊＊＊

(＊＊＊: 80.0 to 99.9 [0.1 step , unit : %])

20) Setting of XdB DOWN for occupied bandwidth measurement

Command : OBWDB＊＊＊

(＊＊＊: 0.1 to 80.0 [0.1 step , unit : dB])

21) Setting of antenna for electric field strength measurement

Command : EFANT＊＊＊＊

(＊＊＊＊: M401 / M402 / M403 / M404
/ M405 / M406 /M407 / USER)

Command	Antenna
M401	Setting data for M401
M402	Setting data for M402
M403	Setting data for M403
M404	Setting data for M404
M405	Setting data for M405
M406	Setting data for M406
M407	Setting data for M407
USER	Setting data for user's original antenna

22) Transfer of user-compensation data for electric field strength measurement

Command : EFUSER＊＊＊＊＊

(Refer to "25.8 Writing of original compensation data" for the details.)

23) Setting of probe for magnetic field strength measurement

Command : MFPROBE＊＊＊＊

(＊＊＊＊: CP2S / USER)

Command	Probe
CP2S	Setting data for CP-2S
USER	Setting data for user's original probe

24) Transfer of user-compensation data for magnetic field strength measurement

Command : MFUSER＊＊＊＊＊

(Refer to "25.8 Writing of original compensation data" for the details.)

25) Start and Stop of calculation function

Command : CALC＊＊＊

(＊＊＊: OFF / MAX / MIN / AVE / OVR)

Command	Calculation
OFF	OFF
MAX	MAX HOLD
MIN	MIN HOLD
AVR	AVERAGE
OVR	OVER WRITE

26) Setting of number of times of sweep for MAX HOLD

Command : MAXNO＊＊＊＊

(＊＊＊＊: 2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 / 1024 / 0)　　* 0 = unlimited

27) Setting of number of times of sweep for MIN HOLD

Command : MINNO＊＊＊＊

(＊＊＊＊: 2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 / 1024 / 0)　　* 0 = unlimited

28) Setting of number of times of sweep for AVERAGE

Command : AVENO＊＊＊＊

(＊＊＊＊: 2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 / 1024)

29) Setting of number of times of sweep for OVERWRITE

Command : OVWNO＊＊＊＊

(＊＊＊＊: 2 / 4 / 8 / 16 / 32 / 64 / 128 / 256 / 512 / 1024 / 0)　　* 0 = unlimited

30) Setting of display scale

Command : SCALE＊＊

(＊＊: 2 / 5 / 10)

Command	Display scale
2	2dB/div
5	5dB/div
10	10dB/div

31) Setting of sweep time

Command : SWEEP＊＊＊＊

(＊＊＊＊: 10M / 30M / 0.1S / 0.3S / 1S / 3S / 10S / 30S / AUTO / ALL)

Command	Sweep time
10M	10ms
30M	30ms
0.1S	0.1s
0.3S	0.3s
1S	1s

Command	Sweep time
3S	3s
10S	10s
30S	30s
AUTO	AUTO
ALL	ALL AUTO

32) Setting of detection mode

Command : DET＊＊＊

(＊＊＊: POS / NEG / SMP)

Command	Detection mode
POS	Positive peak mode
NEG	Negative peak mode
SMP	Sample mode
QP	QP mode (only for MSA438E)
AVG	AVG mode (only for MSA438E)

33) Setting of trigger source

Command : TRG＊＊

(＊＊: INT / EXT)

Command	Trigger source
INT	Internal
EXT	External

34) Request of AUTOTUNE

Command : AUTO　　* The response is returned after tuning.

35) Request of action

Command : HOLD / RUN

36) Request of marker information

Command : MKRRES　　* Example of returned data : 1.42G -15dBm

37) Setting of marker mode

Command : MKR＊＊＊＊＊

(＊＊＊＊＊: NORM / DELTA)

Command	Marker mode
NORM	Normal marker
DELTA	Delta marker

38) Setting of marker position by frequency

The position of active marker is set by frequency.

Command : NORMMKR＊＊＊＊＊＊＊

(＊＊＊＊＊＊＊: Refer to "25.6 Input of frequency")

39) Setting of marker position by number of points on horizontal axis

The position of active marker is set by number of points on horizontal axis.

Command : MKRPOSI＊＊＊

(＊＊＊: 0 to 500　0 = far left, 500 = far right)

40) Setting of peak search mode

Command : PEAK＊＊＊＊

(＊＊＊＊＊: NORM / ZONE)

Command	Peak search mode
NORM	Normal peak search
ZONE	Zone peak search

41) Request of peak search

Command : PKSEARCH＊＊

(＊＊: 01 / 02 / 03 / 04 / 05 / 06 / 07 / 08 / 09 / 10 / 11)

Command	Destination of marker
01	The maximum peak on the screen
02	The 2nd peak on the screen
･･･	･･･
11	The 11th peak on the screen

42) Setting of zone center frequency for peak search

Command : PKCNTR＊＊＊＊＊＊＊

(＊＊＊＊＊＊＊: Refer to "25.6 Input of frequency")

43) Setting of zone width for peak search

Command : PKWIDTH＊＊＊＊＊＊＊

(＊＊＊＊＊＊＊: Refer to "25.6 Input of frequency")

44) Setting of unit of marker

Command : CONV＊＊＊

(＊＊＊: DBM / W / DBV / V / DBUVM / VM)

Command	Unit of marker
DBM	dBm
W	W
DBV	dBV
V	V
DBUVM	dBμV/m
VM	V/m

45) Request of print on printer

Command : PRT＊

(＊=S/W)

USB printer connected to USB A plug prints.

46) Request for transfer of spectrum

Command : SRS＊＊＊＊

(＊＊＊＊: CURR / 000 to 199)

Command	Transferred spectrum
CURR	Current spectrum
000	Spectrum data of 000
・・・	・・・
199	Spectrum data of 199

* The number of the command is given to the saved file.
* Refer to "25.7 Transfer of spectrum data" for the returned data.

47) Request for transfer of spectrum in USB memory

Command : SRSU＊＊＊＊

(＊＊＊＊: 000 to 199)

Command	Transferred spectrum
000	Spectrum data of 000 in USB memory
・・・	・・・
999	Spectrum data of 999 in USB memory

* The number of the command is given to the saved file.
* Refer to "25.7 Transfer of spectrum data" for the returned data.

48) Request for transfer of spectrum data of 1001 points

Command : SRSF * Refer to "25.7 Transfer of spectrum data" for the returned data.

49) Request of preset

Command : PRESET

50) Setting of remote control

Command : REMOTE＊＊＊

(＊＊＊: ON / OFF)

Command	Remote control
ON	Operation by function key and encoder cannot be done. Control the unit with USB commands.
OFF	Operation by function key and encoder can be done. USB commands are available

* When the remote control is ON, "REMOTE" is displayed in the operating information area on the screen

. (Refer to "4. Explanation of screen" for the details.)

51) Single sweep

Command : CAPT * It sweeps only once and will be in a HOLD state.

52) Setting of offset level

Command : OFFSET * * * * *

(* * * * * : -50.0 to 50.0 [0.1 step, unit: dB])

53) Setting input impedance

Command : IMP * *

(* * : 50 / 75)

Command	Offset level
50	Offset level is set to 0dB.
75	Offset level is set to 5.7dB.

* When the input impedance is selected, the offset level is set as described above.

* When "75" is selected, attach the adapter MA301 (option) to the input connector.

54) Clearing of spectrum data and parameter

Command : MCLR * * *

(* * * :ALL / 000 to 199)

Only an internal memory is effective.

Command	Cleared data
ALL	All of data
000	Data of 000
...	...
199	Data of 199

55) Setting of character for label

Command : LBL * * *

(* * * : The number of characters is 16 or less)

56) Setting of clock

Command : CLC * * *

(* * * : aabbccdd ; aa: two last digits of year, bb: month (01 to 12), cc: hour (00 to 23), dd: minute (00 to 59)

57) Setting of tracking generator

Command : TG * *

(* * * : ON / OFF)

58) Setting of normalizing function

Command : NORM * *

(* * * : ON / OFF)

59) Request the HOLDRUN

Command : HOLDRUN

60) Setting of SAVE/LOAD device

Command : DEV * * *

(* * * :MEN/USB)

61) Request ON or OFF of offset level

Command : OFFSETOF?

*The returned data : ON or OFF

25.6 Input of frequency

The frequency is input as follows.

＊＊＊＊＊＊＊: 0.0k to 999.9k (0.1 step, unit: Hz)

: 0.0M to 999.9M (0.1 step, unit: Hz)

: 0.0000G to 3.3G (0.0001 step, unit: Hz) ---- MSA438 (E/TG)

: 0.0000G to 8.5G (0.0001 step, unit: Hz) ---- MSA458

* The offset frequency and the zone width can be input only in the range decided by the center frequency and frequency span. If the value out of the range is input, an error occurs.
* The offset frequency and the zone width change when the frequency span is changed.

25.7 Transfer of spectrum data

The spectrum data is output as a numeric string divided by “, (comma)”. [**.**, **.**, ……, **.**]

The unit is dBm, and it is available to two places of decimals.

●Description

String	Explanation	Example
SPECT	The data which follows the string "SPECT" is the spectrum data.	SPECT
＊＊, ＊＊, ･･･	It is the spectrum data. This string consists of all data points separated by a comma “,” after each data value, and the string can have a total of ten data points per line. For example, transferring spectrum data of 1001 points require a total of 101 lines	-102.01, -102.03, ･･･, ･･･, -110.12,

25.8 Writing of original compensation data

When antennas or probes other than the option is used in electric field strength measurement or magnetic field strength measurement, it is necessary to write each original compensation data into the unit.
Please write the data into the unit according to the following description.
There are two methods for writing, the method of using PC software MAS400 (option) and the method of using original program which is prepared by user.

1) Preparation items

* USB cable MI400
* Windows PC (with USB interface) [The writing cannot be done with MSA400 series unit only.]
* PC software MAS400 (in case of "3) Method of using PC software MAS400 for writing")

2) Example of writing data

As an example, the compensation data (antenna gain) of antenna M405 and the compensation data (compensation coefficient) of magnetic field probe CP-2S are shown below.

* Compensation data (antenna gain) of antenna M405

Frequency	300MHz	350MHz	400MHz	450MHz	500MHz
Antenna gain	0.0dBi	1.0dBi	1.4dBi	1.4dBi	0.0dBi

* Compensation data (compensation coefficient) of magnetic field probe CP-2S

Frequency	10MHz	100MHz	1GHz	2GHz	3GHz
Compensation coefficient	86.7dB	69.2dB	50.7dB	44.9dB	40.1dB

* Even the data of ten points or less can be written. The data cannot be written in 0Hz.

3) Method of using PC software MAS400 for writing

1. Create the text file of compensation data.

Create a new text file by new creation of a personal computer, and open by the text editor.
Write the frequency and compensation data in the following format.

* Format

"frequency": "compensation data", "frequency": "compensation data", ···

Example of M405

300M:0.0DBI,350M:1.0DBI,400M:1.4DBI,450M:1.4DBI,500M:0.0DBI

* Write the unit with a capital letter. G(GHz) is also available.

2. Write the text file into the unit with PC software MAS400.

Connect the personal computer to MSA400 series with USB cable MI400, and turn on the power of MSA400 series.
From the upper menu of PC software MAS400,
select [File] → [Write E/F User Data] in case of electric field strength measurement, or
select [File] → [Write M/F User Data] in case of magnetic field strength measurement.

When the text file created beforehand is selected, the data is written.

* Install the specified USB driver in the personal computer to be used in advance.
(Refer to "25.3 Installation of driver")

4) Method of using original program for writing

1. Prepare the USB communication software.

Connect the personal computer to MSA400 series with USB cable MI400, and turn on the power of MSA400 series.

2. Write the data into the unit.

Transfer the data in the following format with the USB communication software.

* Format

In case of electric field strength measurement;

EFUSER "frequency": "compensation data", "frequency": "compensation data", ···

In case of magnetic field strength measurement;

MFUSER "frequency": "compensation data", "frequency": "compensation data", ···

Example of CP-2S

MFUSER10M:86.7DB,100M:69.2DB,1G:50.7DB,2G:44.9DB,3G:40.1DB

* Write the unit with a capital letter.

3. When the writing ends correctly, "OK" is returned.

5) How to use

Set the measuring function of MSA400 series to electric field strength measurement mode or magnetic field strength measurement mode.

By pushing [MEAS] → [E/F ANT], electric field strength measurement mode is set.

By pushing [MEAS] → [M/F PROBE], magnetic field strength measurement mode is set.

Select "USER" from antennas or probes on the display by pushing [F1].

Then, the measurement by the written data is started.

* The written data remains even if it turns off power.

* The measuring mode returns to a usual measurement when turning off power.

6) About antenna gain

In this contents, the antenna gain means an absolute gain.

When the antenna gain is a relative gain, it can change into an absolute gain by adding +2.15dB.

Absolute gain [dBi] = Relative gain [dBd] + 2.15dB

As reference, the conversion formula to electric field strength is using the following.

$E=\sqrt{(480\pi^2 \times Pa \div (Ga \times \lambda^2))}$

E: Electric field strength [V/m]

Pa: Received electric power [W]

Ga: Antenna gain [times] = $10^{(\text{antenna gain [dBi]} \div 10)}$

λ: Wavelength [m] = $(3 \times 10^8) \div$ frequency [Hz]

26. Option

■ PC software MAS400

MAS400 is a software that controls the spectrum analyzers of four models by the PC. 1001 points are captured in the spectrum analyzer. Although 501 points are displayed on its screen, the number of points transferred to the PC is all of 1001 points.

The screen image is stored by BMP format and the spectrum is stored by CSV format each point (frequency and level).

■ Logging software MAS410

MAS410 is a logging software that collects the measurement data by uninhabited. It is optimum for watching an abnormal signal at night and recording the data by uninhabited for a long time.

・Logging at specified frequency band, sampling interval and measurement time.

・Makes it possible to fast-forward and fast-rewind the images in the file like a video recorder, and moreover, to jump to the image with spectrum exceeding the limit line.

・ERROR is automatically displayed when the signal exceeding the limit line is input.

■ VSWR bridge MVS300

Specification

Frequency range	:	5 to 3000MHz
Directivity	:	more than 40dB @ 50 to 3000MHz
		more than 25dB @ 5 to 50MHz
Insertion loss	:	Less than 7dB @ SOURCE to DUT
		Less than 8dB @ DUT to REFLECTED
Dimensions	:	50(W)×31(H)×114(D)mm
Weight	:	Approx. 240g
Connectors	:	SMA(J) (for three ports)

■ Dipole antenna M401 to M407

Connector : N(P)

Refer to "19.4 Electric field strength measurement" for the details.

■ Magnetic field probe CP-2S

Refer to "19.5 Magnetic field strength measurement" for the details.

Specification

Frequency range	:	10MHz to 3GHz
Space resolution	:	approx.0.25mm (depending on objects)
Dimensions	:	outside 12φ×135mm
		probe tip 2mm(W)×1mm(T)
Connectors	:	SMA(P)

■ USB printer

With AC adaptor and one roll paper

Refer to "23. Storage and print of screen image" for the details.

Specification

Printing method	:	Thermal line dot method
Paper	:	80mm width thermal paper
Power source	:	internal : AA-sized alkaline battery (4 pcs)
		external : 7.5VDC/3A (dedicated AC adapter)
Dimensions	:	134(W)×60(H)×180(D)mm
Weight	:	approx.450g (mainframe only)
Interface	:	USB 2.0

■ Roll printer (10 rolls)

For USB printer

■ Frequency counter (factory option)

Refer to "19.6 Frequency counter (factory option)" for the details.

■ Lithium-ion battery MB400

7.4V/5000mAh Refer to "6.4 Installation of battery" for the details.

■ USB cable MI400

Connector : A plug/ B plug Length : 1m

■ Coaxial attenuator MG-XXdB

Model	Attenuation error		VSWR	Rated power
	DC to 12.4GHz	12.4GHz to 18GHz		
MG-1dB, 2dB, 3dB, 4dB	＜±0.5dB	＜±1dB	＜1.15@DC to 4GHz ＜1.2@4 to 12.4GHz ＜1.3@12.4 to 18GHz	1W
MG-5dB, 6dB, 7dB, 8dB	＜±0.7dB	＜±1.2dB		
MG-9dB, 10dB, 12dB, 13dB	＜±1.0dB	＜±1.25dB		
MG-14dB, 15dB, 20dB	＜±1.2dB	＜±1.3dB		
MG-30dB	＜±1.2dB@DC to 8GHz		＜1.2@DC to 8GHz	

※ Connector, impedance : SMA(P)/SMA(J), 50Ω

■ Terminator

Model	Freq. range	VSWR				Rated power	Connector
		DC to 4GHz	4 to 8GHz	8 to 12.4GHz	12.4 to 18GHz		
MG-50S	DC to 18GHz	＜1.08	＜1.10	＜1.15	＜1.20	0.25W	SMA(P)
MG-50N	DC to 8GHz	＜1.2@DC to 8GHz				2W	N(P)

※ Impedance : 50Ω

■ Coaxial cable

Model	Connector	Length	Freq. range
MC102	SMA(P)/BNC(P)	1.5m	DC to 2GHz
MC201	SMA(P)/SMA(P)	0.5m	DC to 18.5GHz
MC202	SMA(P)/SMA(P)	3m	DC to 18.5GHz
MC203	SMA(P)/SMA(P)	4m	DC to 18.5GHz
MC204	SMA(P)/SMA(P)	1.5m	DC to 12.4GHz
MC301	SMA(P)/SMA(P)	0.5m	DC to 10GHz
MC302	SMA(P)/SMA(P)	1m	DC to 10GHz
MC303	SMA(P)/SMA(P)	1.5m	DC to 10GHz
MC304	SMA(P)/N(J)	0.2m	DC to 4GHz
MC305	SMA(P)/N(P)	0.2m	DC to 4GHz
MC306	SMA(P)/BNC(J)	0.2m	DC to 2GHz
MC307	SMA(P)/BNC(P)	0.2m	DC to 2GHz
MC308	N(P)/N(P)	0.5m	DC to 10GHz
MC309	N(P)/N(P)	1m	DC to 10GHz
MC310	N(P)/N(P)	1.5m	DC to 10GHz
MC311	N(P)/SMA(J)	0.2m	DC to 10GHz
MC312	N(P)/BNC(J)	0.2m	DC to 2GHz
MC313	N(P)/BNC(P)	0.2m	DC to 2GHz
MC314	BNC(P)/BNC(P)	1.5m	DC to 2GHz

※ Impedance : 50Ω

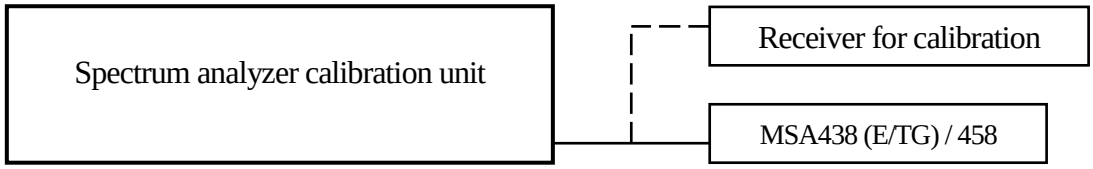
■ Adapter

Model	Connector	Impedance	Freq. range
MA301	BNC(P)/BNC(J)	50Ω/75Ω	DC to 2GHz
MA302	BNC(P)/N(J)	75Ω/75Ω	DC to 1.8GHz
MA303	BNC(P)/N(P)	75Ω/75Ω	DC to 1.8GHz
MA304	BNC(P)/F(J)	75Ω/75Ω	DC to 1.8GHz
MA305	BNC(P)/F(P)	75Ω/75Ω	DC to 1.8GHz
MA306	N(P)/SMA(J)	50Ω/50Ω	DC to 12.4GHz
MA307	N(P)/BNC(J)	50Ω/50Ω	DC to 2GHz
MA308	N(P)/BNC(J)	50Ω/75Ω	DC to 2GHz
MA309	N(J)/BNC(P)	50Ω/50Ω	DC to 2GHz

27. Basis Performance Test (MSA438/438E/438TG/458)

To keep the quality of the unit, regular performance testing is recommended. This section describes a method and specification of basic performance testing. If a problem is found in the results of basic performance testing, or formal testing is needed, please contact the agency where you purchased the product, or contact us.

[Connection diagram]



27.1 Frequency characteristics

Adjust the output level of the spectrum analyzer calibration unit (thereafter, "calibration unit") so that the displayed power value is -15dBm at each frequency for this unit, and measure the absolute value with a receiver for calibration (microwave power meter, etc.).

Setting of MSA438 (E/TG) /458			Specifications	Measurement value	Judgment
Center frequency	Frequency span	RBW			
10MHz	10MHz	3MHz	Within Reference±2.0dB±1dot		
100MHz	10MHz	3MHz	Reference		
1GHz	10MHz	3MHz	Within Reference±1.0dB±1dot		
2GHz	10MHz	3MHz	Within Reference±1.0dB±1dot		
3.3GHz	10MHz	3MHz	Within Reference±1.0dB±1dot		
6.2GHz *1	10MHz	3MHz	Within Reference±1.0dB±1dot		
8.5GHz *1	10MHz	3MHz	Within Reference±1.0dB±1dot		

*1 MSA458 only

・Setting of MSA438 (E/TG) /458

Reference level : -15dBm
VBW : 1MHz
Sweep time : 1s
Detection mode : SMPL
Display scale : 2dB/div

・Setting of calibration unit

Frequency : Same as a center frequency of MSA438 (E/TG) /458.

Output power : Adjust the power indication of MSA438 (E/TG) /458 to -15dBm.

27.2 Accuracy of reference level

Adjust the output level of the calibration unit so that the displayed value of this unit is the 0th div from the top, and calibrate the absolute value with the receiver for calibration (microwave power meter, etc.).

Setting of MSA438 (E/TG) /458 Reference level	Specifications	Measurement value	Judgment
+10dBm	within ±1.4dB±1dot		
0dBm	within ±1.4dB±1dot		
-10dBm	within ±1.4dB±1dot		
-15dBm	within ±0.8dB±1dot		
-20dBm	within ±1.4dB±1dot		
-30dBm	within ±1.4dB±1dot		
-40dBm	within ±1.4dB±1dot		

* Input attenuator switching error is included at the reference level other than -15dBm.

·Setting of MSA438 (E/TG) /458

Center frequency : 100MHz
Frequency span : 10MHz
RBW : 3MHz
VBW : 1MHz
Sweep time : 1s
Detection mode : SMPL
Display scale : 2dB/div

· Setting of calibration unit

Frequency : 100MHz
Output power : Adjust it so that the indicated value of MSA438 (E/TG) /458 is at the 0th div from the top.

27.3 Display accuracy of center frequency

Measure the frequency with the peak search function of MSA438 (E/TG) /458.

Setting of MSA438 (E/TG) /458			Specifications	Measurement value Center frequency	Judgment Frequency span
Center frequency	Frequency span	RBW			
100MHz	200kHz	3kHz	within ±50kHz±1dot ±4kHz	100MHz	200kHz
100MHz	10MHz	30kHz		100MHz	10MHz
100MHz	20MHz	100kHz	within ±360kHz±1dot ±RBW × 20%	100MHz	20MHz
100MHz	200MHz	100kHz		100MHz	200MHz
1GHz	20MHz	100kHz		1GHz	20MHz
2GHz	20MHz	100kHz		2GHz	20MHz
3.3GHz *1	20MHz	100kHz		3.3GHz *1	20MHz
6.1GHz *2	20MHz	100kHz		6.1GHz *2	20MHz
8.5GHz *2	20MHz	100kHz		8.5GHz *2	20MHz

*1 MSA438 (E/TG) only *2 MSA458 only

· Setting of MSA438 (E/TG) /458

Reference level : -15dBm
VBW : AUTO
Sweep time : 1s
Detection mode : SMPL
Display scale : 10dB/div

· Setting of calibration unit

Frequency : Same as a center frequency of MSA438 (E/TG) /458.
Output power : -15dBm
* However, calibrate the signal generator in advance.

27.4 Display accuracy of frequency span

Adjust the frequency of the calibration equipment so that the peaks are at the positions of f_1 and f_9, and measure the frequencies of f_1 and f_9. Calculate from f_1 and f_9 the display accuracy of the frequency span.

＊f_1: 1st div from the left on the spectrum display　f_9: 9th div from the left on the spectrum display

Setting of MSA438 (E/TG) /458			Specifications	f_1 Measurement value	f_9 Measurement value	(f_9 - f_1)	Judgment
Frequency span	Center Frequency	RBW					
200kHz	1GHz	3kHz	within ±160kHz ×3%±1dot				
10MHz	1GHz	100kHz	within ±8MHz ×3%±1dot				
20MHz	1GHz	300kHz	within ±16MHz ×3%±1dot				
200MHz	1GHz	3MHz	within ±160MHz ×3%±1dot				
500MHz	1GHz	3MHz	within ±400MHz ×3%±1dot				
2GHz	1GHz	3MHz	within ±1.6GHz ×3%±1dot				
FULL(3.3GHz)*1	1.65GHz	3MHz	within ±2.64GHz ×3%±1dot				
2GHz *2	4.8GHz	3MHz	within ±1.6GHz ×3%±1dot				
2GHz *2	7.4GHz	3MHz	within ±1.6GHz ×3%±1dot				
FULL(8.5GHz)*2	4.25GHz	3MHz	within ±6.8kHz ×3%±1dot				

*1 MSA438 (E/TG) only　*2 MSA458 only

· Setting of MSA438 (E/TG) /458

Reference level : -15dBm
VBW : AUTO
Sweep time : One step slower than AUTO
Detection mode : SMPL
Display scale : 10dB/div

· Setting of calibration unit

Frequency : Adjust it to the positions of f_1 and f_9.
Output power : -15dBm

27.5 Linearity of amplitude axis

Adjust the level of the calibration unit so that the peak is at the top of the amplitude axis (0th div), and regard the point set at that time as the reference. Gradually lower the output, starting from the reference, and measure the amplitude value of MSA438 (E/TG) /458.

Setting of MSA438 (E/TG) /458 Display scales	Output of calibration unit	Specifications	Measurement value	Judgment
10dB/div	**X**dBm (adjust it to the 0th div)	Reference(-15dBm)	(-15dBm)	
	X-10dBm	Within -25dBm±0.8dB±1dot		
5dB/div	**X**dBm (adjust it to the 0th div)	Reference(-15dBm)	(-15dBm)	
	X-5dBm	Within -20dBm±0.4dB±1dot		
2dB/div	**X**dBm (adjust it to the 0th div)	Reference(-15dBm)	(-15dBm)	
	X-2dB	Within -17dBm±0.2dB±1dot		

·Setting of MSA438 (E/TG) /458

Center frequency : 100MHz
Frequency span : 10MHZ
RBW : 3MHz
VBW : 1MHz
Sweep time : 1s
Detection mode SMPL

· Setting of calibration unit

Frequency : 100MHz

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