Instruction Manual

Model 2650 3.3GHz Spectrum Analyzer

Before Starting To Use The Unit

?When you use the unit, please observe the following notes listed on the rear of the body.

?For you to use it safely

1) When abnormal sounds, abnormal smell and smoke are emitting from the unit, remove the battery and AC adapter and stop the use.
2) Never use with hands that are wet, because doing so may cause damage to the unit and/or cause electric shock to the user.
3) Never use under the thunder clouds, because doing so may cause damage to the unit and/or cause electric shock to the user.
4) Never use an AC adapter other than the one specified, because doing so may cause damage to the unit. 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.
5) Never use a battery other than the one specified, because doing so may cause damage to the unit. When removing or installing the battery, be sure to do it after you turn off the unit and disconnect the AC adapter.
6) When replacing the fuse, disconnect the AC adapter, open the battery cover on the back and remove battery, and then take sufficient care to perform the replacement. Use a 5A/250V fuse (slow-blow type). Never use a fuse not specified because doing so may cause damage to the unit.

?Guarantee of quality

Guarantee period

Guarantees that the unit will be repaired for any failure free of charge if the failure occurs because of our responsibility within one year after original owners date of purchase. However, the above guarantee does not apply to such a failure that:

1) is caused by a fire, natural disasters, etc.
2) is caused by inappropriate handling of the unit, such as dropping it while moving it after purchasing.
3) is caused by handling counter to the instructions or precautions listed in the operating manual.
4) is caused by modifying the unit or by being considered to be your responsibility because of inappropriate use.

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

Warm-up time

When turning on the unit, allow it to warm-up for at least 10 minutes, because the temperature inside is low.

Precautions for storage

1) Strictly observe the storage conditions specified for this unit, such as avoiding direct sunlight and dust.
2) Store this unit in a place where -20? ~ 60? , less than 60? /70%RH, variations in temperature and humidity are small.

After service

If you have any question about the contents of this product or how to operate it, please contact us at:

B&K Precision Corporation

22820 Savi Ranch Parkway – Yorba Linda, CA 92887

TEL. 714-921-9095 FAX. 714-921-6422

URL: http: //www.bkprecision.com E-mail: sales@bkprecision.com

Contents

1. Outlines

1.1 Product outlines

2650 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.

1) Compact and lightweight, 3.7lb. (1.7 kg)

The external dimensions are as small as (W×H×D) 6.4×2.8×10.2" (162×70×260 mm), and the weight is only 3.7lb. (1.7 kg) including the battery. It is very convenient for outdoor use and while on business trips.

2) Measuring frequency bandwidth 100kHz to 3.3GHz

This bandwidth covers those of W-CDMA, CDMA, PDC, PHS, GSM, 2.4GHz band wireless LAN, Bluetooth, etc.

3) Operation with battery for 100 minutes

When battery BP 2650 is fully charged, 2650 works for about 100 minutes (with the back light turned off). It is extremely convenient for outdoor use and for use in the survey of wireless LAN installation environment.

4) Performance that is comparable to that of large-size bench type equipment

2650 guarantees a highly stable frequency axis by PLL synthesizer system. The center frequency setup resolution is 100kHz. Furthermore, the mean noise level is -110dBm or less. Thus, a broad dynamic range is secured and the reference level can be set in 1 dB steps.

5) Abundant functions

?Measuring functions· · · Channel power measurement, Adjacent channel leakage power measurement, Occupied frequency bandwidth measurement, Electric field strength measurement, Magnetic field strength measurement.

? Electric field strength measurement: Optimum for measurement of cellular phone and wireless LAN working environment.

? Magnetic field strength measurement: Optimum for EMI design of printed circuit boards and for evaluation of signal quality.

?Calculation functions· · · MAX HOLD, MIN HOLD, AVERAGE, OVER WRITE

?Marker· peak search

?Save/load

6) Auto tuning

The center frequency is set at the spectrum of the maximum level in the 3.3GHz band, and in addition, optimum reference level, resolution bandwidth, video bandwidth and sweep time are set when the AUTO TUNE key is pressed. This function is very convenient for measurement of an unknown signal.

7) Auto range motion

The resolution bandwidth, video bandwidth and sweep time are set automatically based on the set frequency span. It is also possible to set auto range motion only one out of resolution bandwidth, video bandwidth and sweep time.

8) Hard copy of the image

Connect a printer PT 2650 (optional) and press the [PRINT] key on 2650. The image on the screen is printed as it is.

9) High resolution display on the PC screen

The trace is displayed at high resolution, 1,001 points in the horizontal axis, on the PC screen when "PC Software AK 2650" (optional) is used.

1 . 2 Standard accessories

? AC adaptor BC 2650

? Soft carrying case

? Accessory pouch

? Fuse (It has been installed in the inside)

? Operating manual

⑥ Ni-MH Battery BP 2650 (Refer to "6.4 Installing the battery" for details.)

1 . 3 Optional accessories

? Dipole antenna AN 301, AN 302, AN 303, AN 304
(Refer to "19.4 Electric field strength measurement" for details.)

? Magnetic field probe PR 26M with a dedicated double shielded coaxial cable
(Refer to "19.5 Magnetic field strength measurement" for details.)

? PC software AK 2650 (Refer to "24. PC Software" for details.)

? Printer with AC adaptor. 4pcs of AA batteries, a roll paper
(Refer to "21. Printing" for details.)

? Roll paper for optional printer PX 2650 (with 10 rolls)

? SMA coaxial cable CC 301(50cm), CC 302(1m), CC 303(1.5m)

? The bandwidth is DC to 10GHz (VSWR< 1.5)

? Performances change by bending and deteriorate by repeating the insertion and extraction.

2 . Specifications

2 . 1 Performances

¦ Frequency section

Frequency range	50kHz to 3.3GHz
Center frequency	
Setting resolution	100kHz
	Allows Rotary encoder, numeric key and function key
Accuracy	within ±(30+100T)kHz±1dot T: Sweep time(s)
	(frequency span: 200kHz to 10MHz, RBW: 30kHz, 23±5?)
	within ±(100+700T)kHz±1dot T: Sweep time(s)
	(frequency span: 20MHz to 3.3GHz, RBW: 100kHz, 23±5?)
RBW frequency error	within ±6% of RBW (RBW: 3kHz, 30kHz)
	within ±30% of RBW (RBW: 100kHz to 3MHz)
Frequency span	
Setting range	0Hz(zero span), 200kHz to 2GHz(1-2-5step) and 3.3GHz(full span)
Accuracy	within ±3%±20TkHz±1dot (frequency span: 200kHz to 10MHz, 23±5?)
	within ±3%±200TkHz±1dot (frequency span: 20MHz to 3.3GHz, 23±5?)
	T: Sweep time(s)
Display resolution	Frequency span/250
	Frequency span/1000 (only the measurement by RS-232C communication)
Display dot number	251dots, 1001dots (only the measurement by RS-232C communication)
	(The unit displays data in 251 horizontal dots, but it internally captures the trace in 1001 dots)
Resolution bandwidth	3dB bandwidth
Setting range	3kHz to 3MHz(1-3step) and AUTO
Accuracy	within ±20%
Selectivity	1:12 (typical, 3dB : 60dB)
Video bandwidth	100Hz to 300kHz(1-3step), OFF and AUTO
SSB phase noise	-90dBc/Hz (typical, 100kHz offset, RBW: 3kHz, VBW: 100Hz, Sweep time: 0.3s)
Spurious response	less than -60dBc
Harmonics	less than -40dBc (50kHz to 100MHz)
	less than -45dBc (100MH z to 3.3GHz)

¦ Amplitude section

Reference level	
Setting range	+10 to -40dBm(1dB step)
Accuracy	within ±0.8dB±1dot

(center frequency: 100MHz,RBW: 3MHz, VBW: OFF, ATT: 0dB, 23±5?)

Unit	dBm, dBV, dBmV, dBμV, dBμV/m, dBμA/m (dBμV/m and dBμA/m is used the measuring function)
Average noise level	-110dBm (typical, center frequency: 100MHz, RBW: 3kHz, VBW: 100Hz)
Frequency Characteristic	within ±2.0dB±1dot (50kHz to 100MHz) within ±1.0dB±1dot (100MH z to 3.3GHz)
	50O
Input impedance	less than 2.0
Input VSWR	
Input attenuator	0 to 25dB (1dB step), coupled with reference level
Operating range	within ±0.6dB
Switching error	within ±0.6dB
RBW switching error	0.4dB(10dB/div), 0.08dB(2dB/div)
Display resolution	200dots
Display dot number	
Display scale	10dB/div, 2dB/div
Scale	within ±0.2dB/2dB±1dot
Accuracy	within ±0.8dB/10dB±1dot
	within ±1.6dB/70dB±1dot
	+20dBm(CW average power), 25VDC
Input damage level	SMA(J)
Input connector	

¦ Sweep section

Sweep time	10ms to 30s (1-3step, frequency span: 0 to 2GHz) and AUTO
Setting range	30ms to 30s (1-3step, frequency span: full span) and AUTO
	within ±0.1%±1dot (frequency span: 0 to 2GHz)
Accuracy	within ±1.5%±1dot (frequency span: full span)
	AUTO(frequency span: zero span)
Trigger mode	Positive peak, Negative peak, Sample
Detection mode	(When sweep time is 10ms or 30ms, only Sample can be set)

¦ Functions

Marker	NORM: displays frequency(7digits max) and level(4digits max) at marker point.
	DELTA: displays differential frequency and level between 2 markers.
Peak search	NORM: searches a peak point within 10div. Available NEXT peak(10max).

ZONE: searches a peak point within a zone designated by center and width.
Marker moves to a peak point each sweep.

Calculation	NORM, MAX HOLD, MIN HOLD, AVERAGE, OVER WRITE MAX/MIN HOLD: 2 to 1024 times, AVERAGE: 2 to 256
Measuring	Channel power, Adjacent channel leakage power, Occupied frequency bandwidth, Electric field strength(needs optional antenna), Magnetic field strength(needs optional magnetic field probe) measurement
AUTO tuning	When pushing AUTO TUNE key, the maximum level spectrum within 3.3GHz bandwidth is adjusted to center, and reference level, RBW, VBW and sweep time are adjusted to optimum values.
Save/Load	
Save	Saves 100 traces and 100 setups
Load	Loads 1 trace and 1 setup

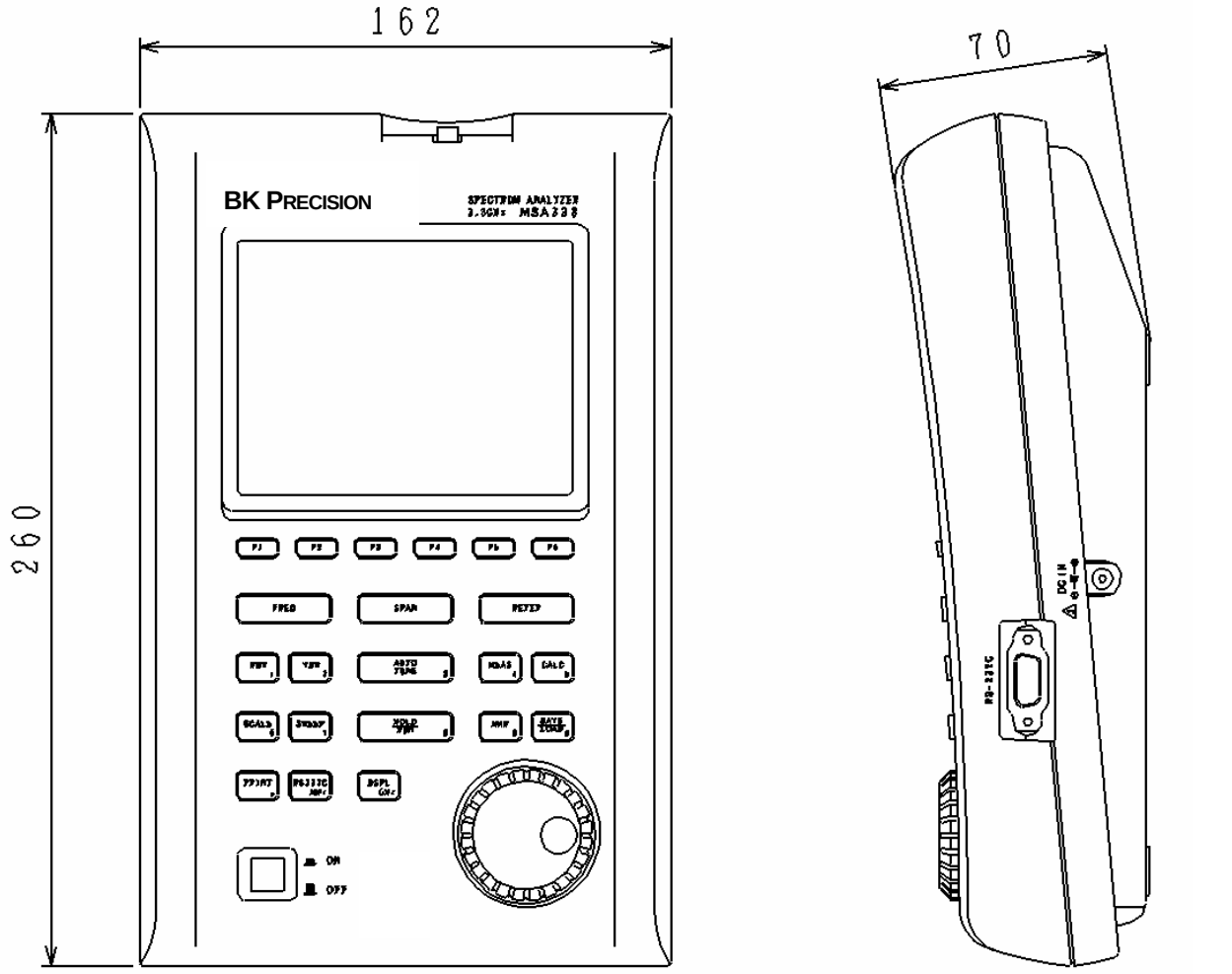
General

Communication	
Interface	RS-232C
Baud rate	2400 to 38400bps
Hard copy	Allows direct hard copy with an optional printer.
Display	
Display	LCD
Backlight	CFL backlight
Resolution	320(H)×240(V)dots
Power source	
Battery	Ni-MH battery
External DC source	Pin jack, DC5V/4A

Other

Operating temperature	0 to 40? (Guaranteed at 23±10? , without soft carrying case)
Operating humidity	less than 40? /80%RH (Guaranteed at less than 33? /70%RH, without soft carrying case)
Storage temperature	-20 to 60? , less than 60? /70%RH
Dimensions	162(W)×70(H)×260(D)mm (exclude projections and stand)
Weight	approx.1.7kg (include battery), approx.1.5kg (without battery)

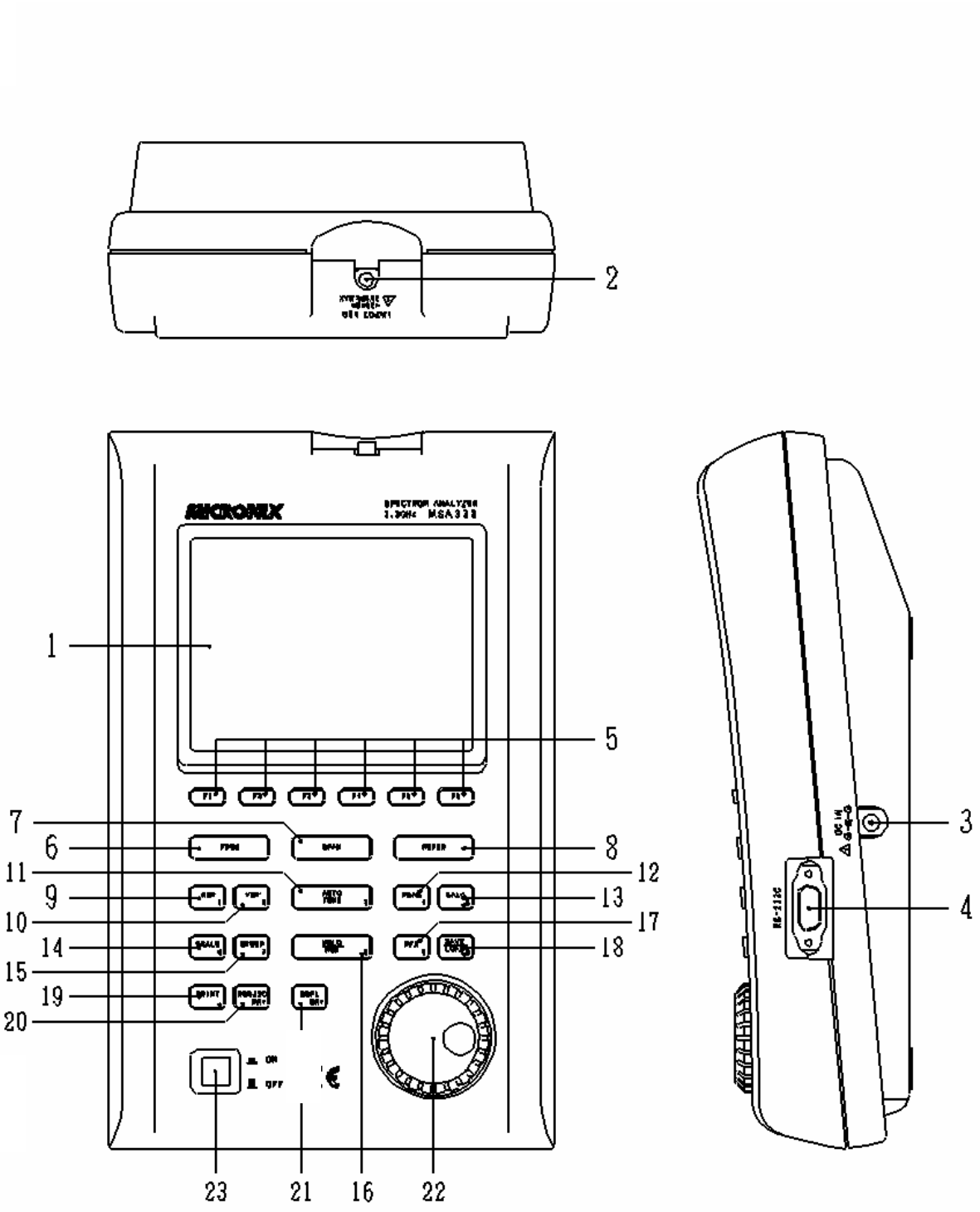
2．2 Outline



[Unit: mm]

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

3． Description Of Panel



1) LCD screen

This is a large liquid crystal display with 320 (H) × 240 (V) dots. It simultaneously displays traces (10 div × 8 div), various setting values, measured values, etc.

2) Input connector

SMA (J) connector.

3) Input connector for DC power source

Connects AC adaptor BC 2650.

4) RS-232C connector

Connects PC and printer, by using RS-232C cable.

5) Function keys (F1 to F6)

Functions change according to operation. Have functions corresponding to the on-screen displays.

6) Center frequency key

Use this key to set the center frequency. It can set between 0 to 3.3GHz (100kHz step).

7) Frequency span key

Use this key to set the frequency span. It can set between 200kHz to 2GHz, ZERO SPAN and FULL SPAN (3.3GHz).

8) Reference level key

Set the reference level. It can set between +10dBm to -40dBm (1dB step).

9) Resolution bandwidth key

10) Video bandwidth key

Use this key to set the video bandwidth. It can set between 100Hz to 300kHz and OFF.

11) AUTO tuning key

Tunes to the maximum level spectrum within 3.3GHz bandwidth. This does not operate normally when the signal level is -40 dBm or lower and the input frequency is 50 MHz or lower and the frequency span is ZERO SPAN and FULL SPAN.

１２） Measuring function key

Available for Channel power, Adjacent channel leakage power, Occupied frequency bandwidth, Electric field strength and Magnetic field strength measurement.

１３） Calculation function key

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

１４） Display scale key

Use this key to select the display scale of amplitude axis from 2dB/div or 10dB/div.

１５） Sweep key

Use this key to set the sweep time between 10ms to 30s or set the detection mode.

１６） Hold/Run key

Stops or restarts the measurement.

１７） Marker· Peak search key

Use this key to set and move a marker.

１８） Save/Load key

Saves 100traces and 100setups, and loads 1trace and 1setup.

１９） Print key

When pressing this key, the image is printed with a printer (PT 2650 optional) as it is.

２０） RS-323C key

Sets baud rate and transfers a current or saved trace.

２１） Display control key

Sets contrast, backlight ON/OFF, brightness of backlight, invert display and buzzer ON/OFF.

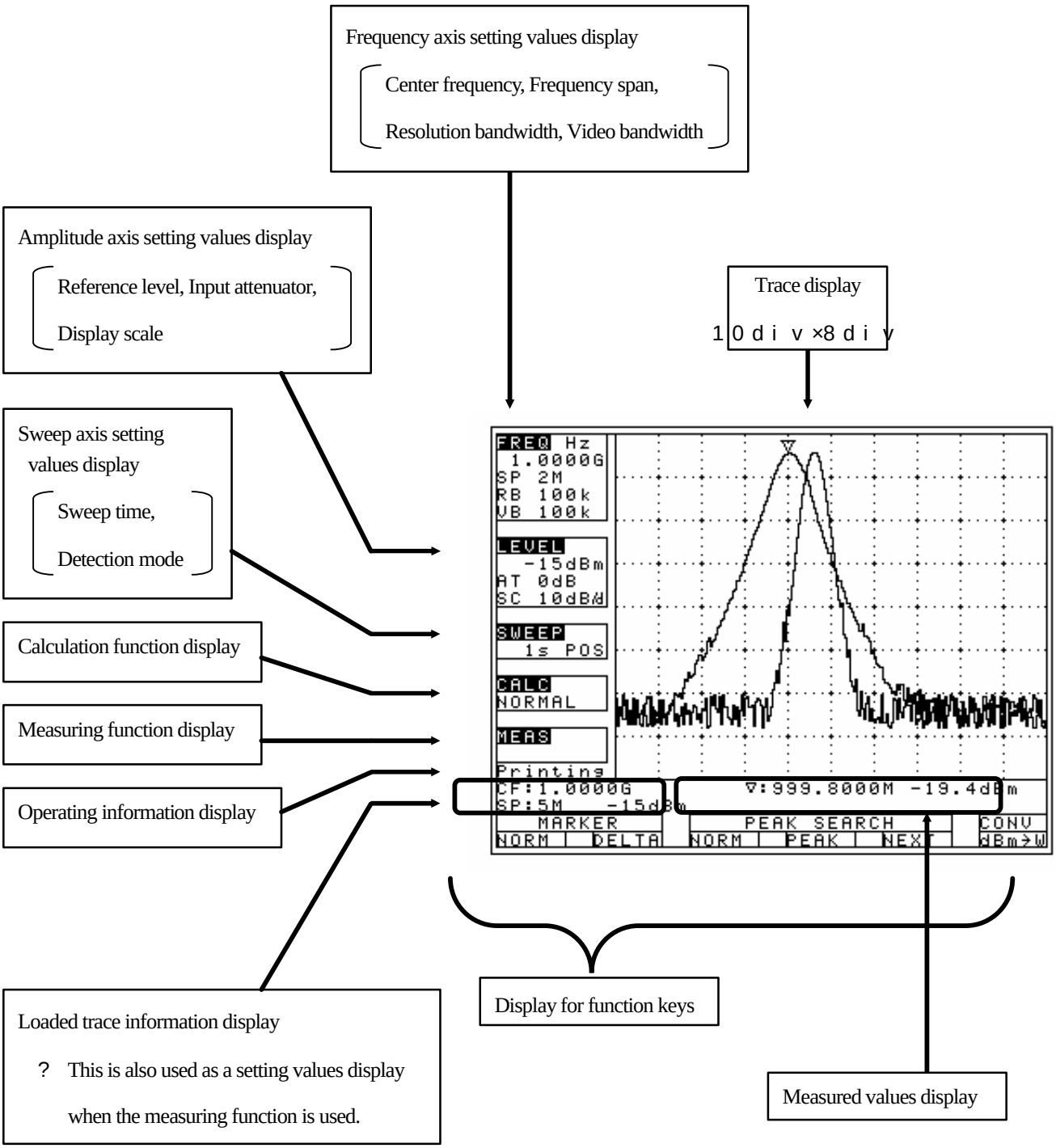
２２） Rotary encoder

Use this to make various settings.

２３） Power switch

Use this to turn the power ON or OFF.

4． Description Of Screen



5 . Function Key Menu

5 . 1 List of the Function key menus

The types of function keys are shown in the table below. For description of each function, see the detailed pages. For the flow of change in the function key display, refer to “5.2 Menu tree”.

	Function key	Key flow	Detailed page
A)	Adj Ch OFS	MEAS?(F6)?(F2)?F2	33
	Adj Ch Pw	MEAS?(F6)?F2	33
	Adj Ch WIDTH	MEAS?(F6)?(F2)?F3	33
	ANT	MEAS?(F6)?(F5)?F1	36
	AVER	CALC?F4	27
B)	B.L.	DSPL?F2	41
	BACK SPACE	FREQ?F5?F6	18
	BAND CNTR	MEAS?(F6)?(F1)?(F1)?F2	32

	Function key menus	Key flow	Detailed page
N)	NORM	CALC?F1	26
	NUM	FREQ?F5	18
O)	Occ BW	MEAS?(F6)?F3	34
	OVRWR	CALC?F5	27
P	PARAM	SAVE/LOAD?F2	29
	PEAK SEARCH CNTR	MKR?(F3)?F4	28
	PEAK SEARCH NEXT	MKR?(F3)?F5	28
	PEAK SEARCH NORM	MKR?(F3)?F3	28
	PEAK SEARCH PEAK	MKR?(F3)?F4	28

	BAND WIDTH	MEAS?(F6)?(F1)?(F1)?F3	32
	BAUD	RS232C?F2	43
	BLCTR	DSPL?F3	41
	BUZZR	DSPL?F5	41
C)	CENTER FREQ ?	FREQ?F1	18
	CENTER FREQ ?	FREQ?F2	18
	Ch Power	MEAS?(F6)?F1	32
	CLEAR	FREQ?F5?F5	18
	CONV	MKR?F6	28
	CTRS	DSPL?F1	41
D)	DET	SWEEP?F4	25
E)	E/F ANT	MEAS?(F6)?(F3)?F4	35
	EncST	FREQ?F4	18
	EXEC	RS232C?F3	43
	EXECUTE DEL	SAVE/LOAD?F5	30
	EXECUTE LOAD	SAVE/LOAD?F4	29

	PEAK SEARCH WIDTH	MKR?(F3)?F5	28
	PEAK SEARCH ZONE	MKR?(F3)?F3	28
	PRE SET	SAVE/LOAD?F6	30
	PROBE	MEAS?(F6)?(F5)?F1	40
R)	RATIO	MEAS?(F6)?(F3)?F2	34
	RBW ALL	RBW?F3	23
	RBW AUTO	RBW?F2	23
	RBW MANU	RBW?F1	23
	REFERENCE CNTR	MEAS?(F6)?(F2)?F4	33
	REFERENCE WIDTH	MEAS?(F6)?(F2)?F5	33
S)	SCALE 10dB	SCALE?F1	22
	SCALE 2dB	SCALE?F2	22
	SET MKR	FREQ?F6	19
	SWEEP ALL	SWEEP?F3	25
	SWEEP AUTO	SWEEP?F2	25
	SWEEP MANU	SWEEP?F1	24
T)	TRACE	SAVE/LOAD?F1	29

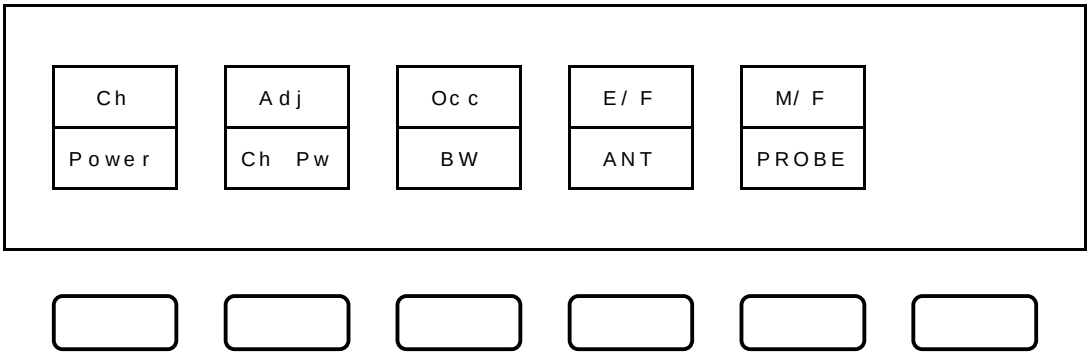
	EXECUTE SAVE	SAVE/LOAD?F3	29
I)	INVT	DSPL?F4	41
K M))	KeyST	FREQ?F3	18
	M/F PROBE	MEAS?(F6)?F5	39
	MAXHD	CALC?F2	26
	MEAS OFF	MEAS?(F1~5)?F6	31
	MINHD	CALC?F3	27
	MKR DELTA	MKR?F2	28
	MKR NORM	MKR?F1	28
	MODE	MEAS?(F6)?(F1~3)?F1	32? 33? 34

		RS232C?F1	43
U)	UNIT dBm	REFER?F1	20
	UNIT dBmV	REFER?F3	20
	UNIT dBV	REFER?F4	20
	UNIT dBμV	REFER?F2	20
V)	VBW ALL	VBW?F3	24
	VBW AUTO	VBW?F2	24
	VBW MANU	VBW?F1	23

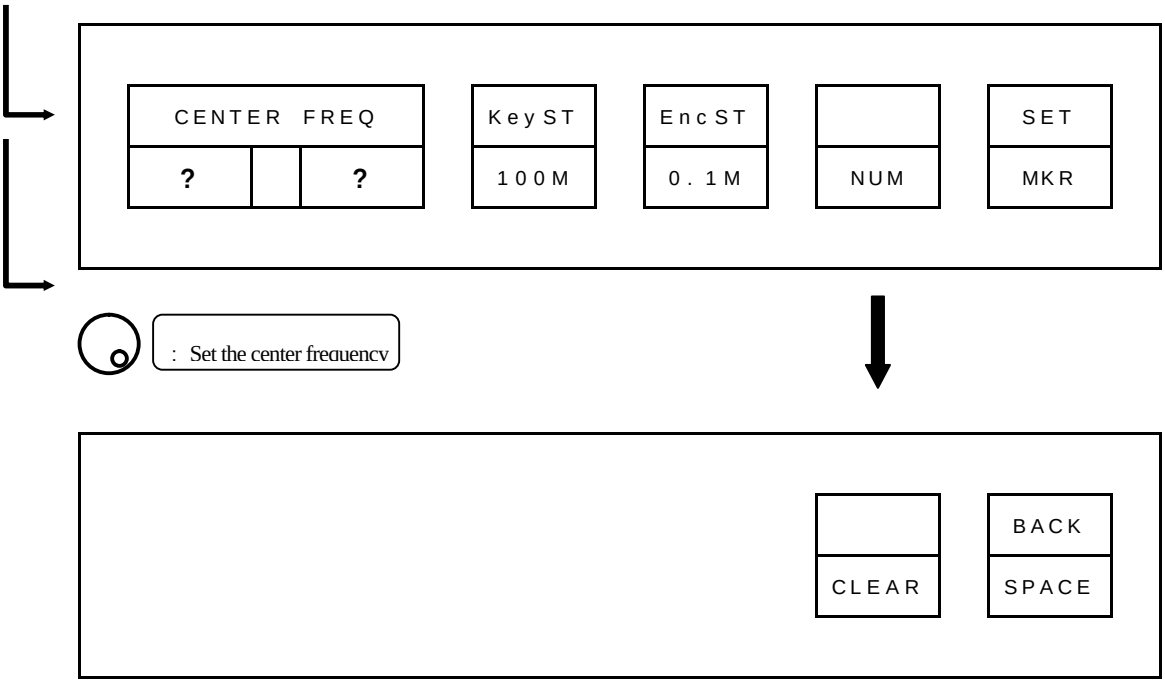
5．2 Menu tree

The displayed items on the bottom of the screen correspond to the function keys under them, as shown in the figure below:

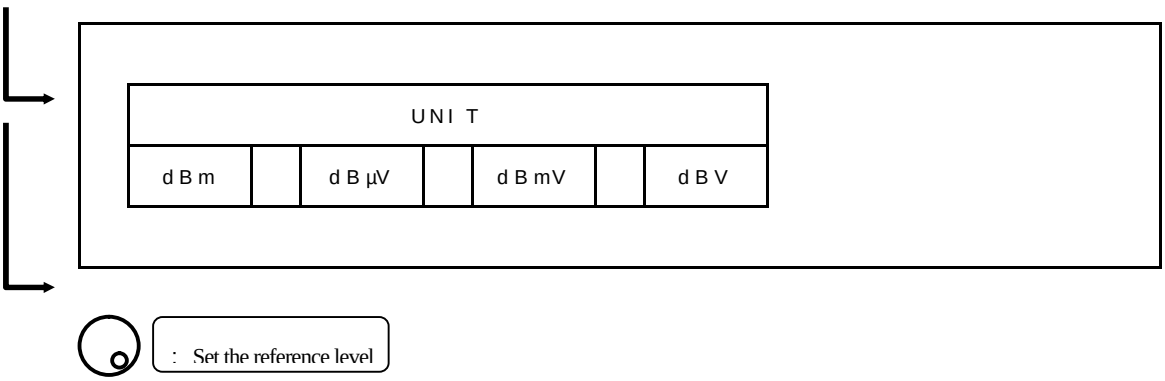
"Displayed items on the bottom of the screen"



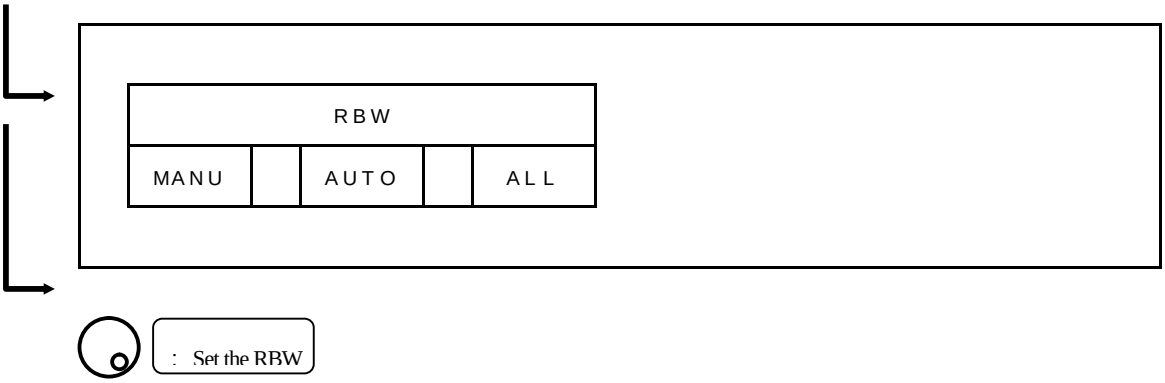
? Refer to “7. Center Frequency” to details



? Refer to “9. Reference Level” to details

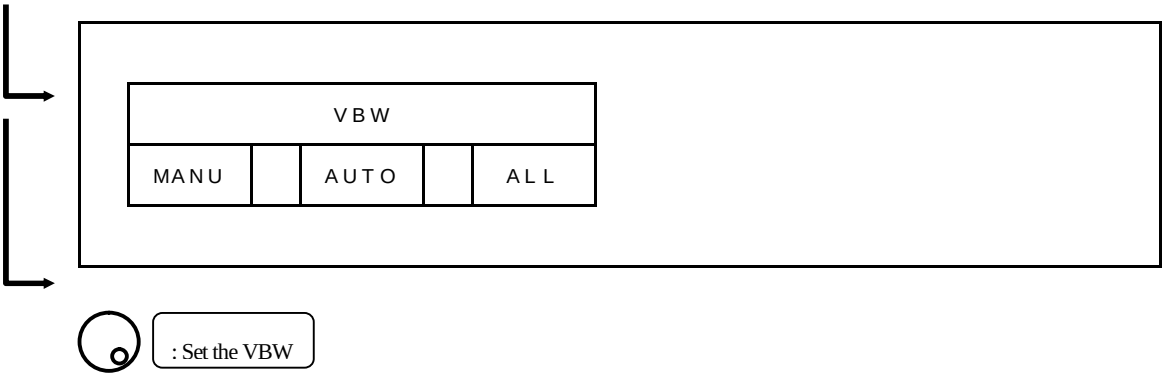


? Refer to “11. Resolution Bandwidth” to details



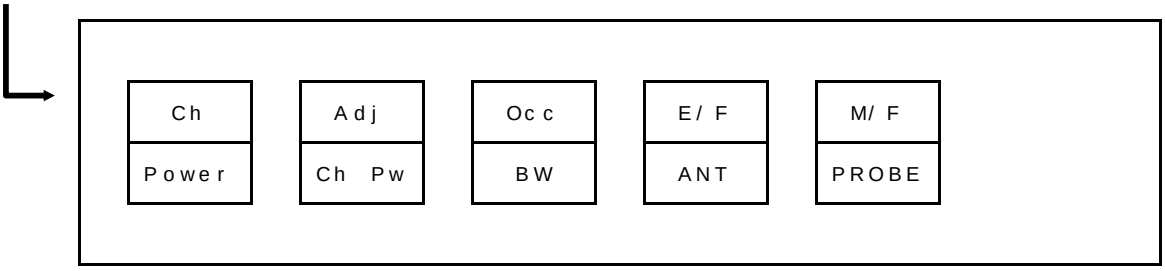
: Set the RBW

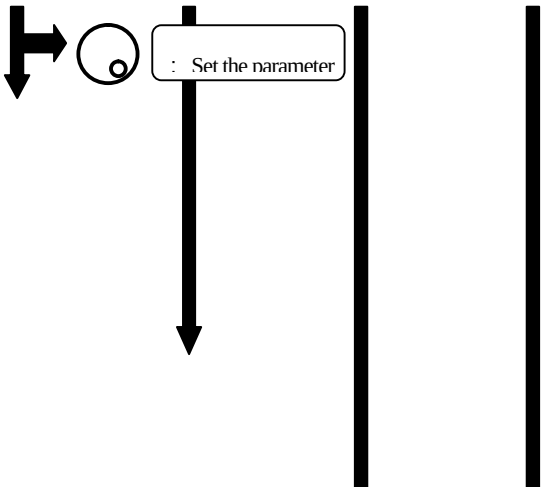
? Refer to “12. Video Bandwidth” to details

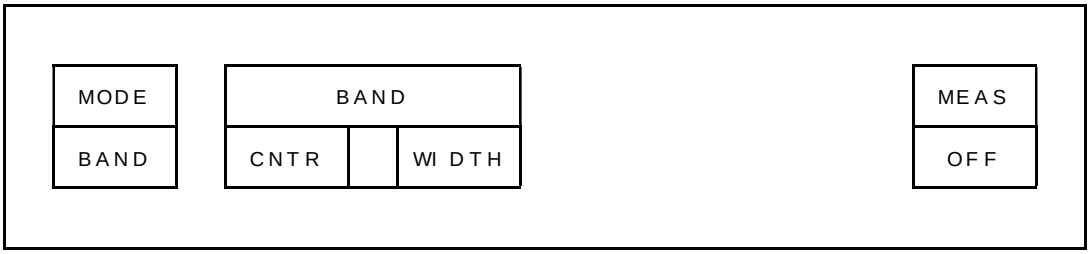


: Set the VBW

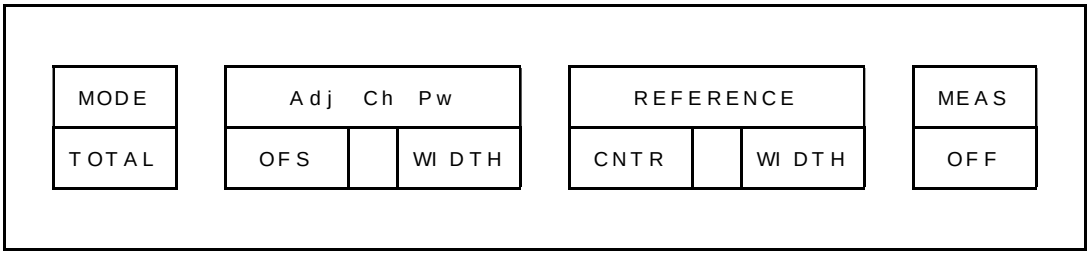
(1 /2) ? Refer to “19. Measuring Function” to details

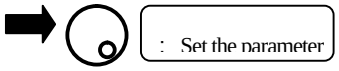


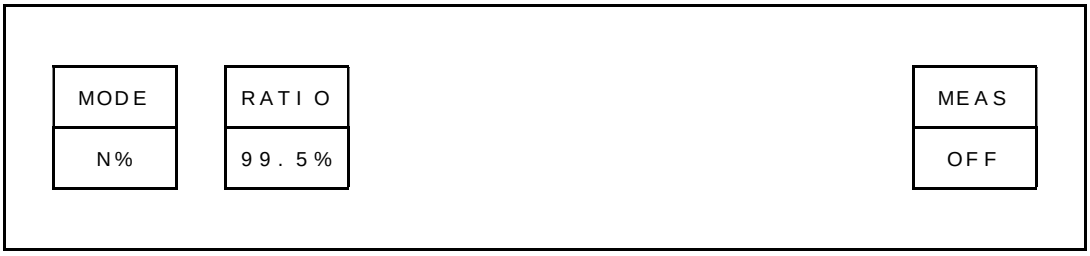



MODE
BAND
BAND
CNTR
WIDTH
MEAS
OFF


: Set the parameter

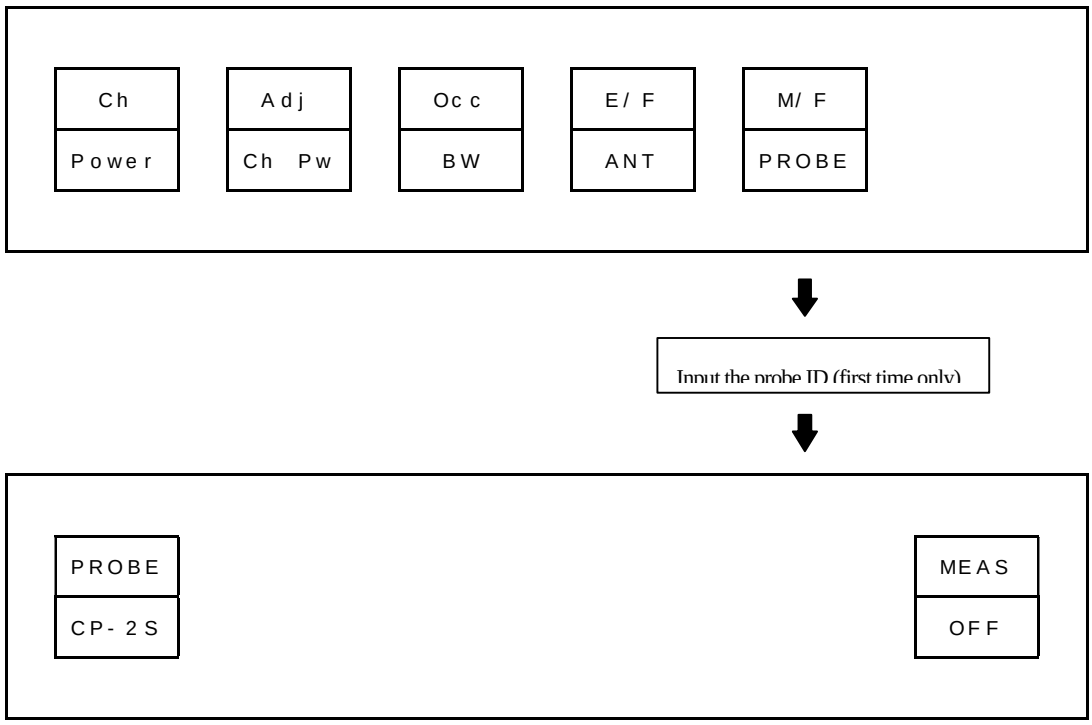

MODE
TOTAL
Adj Ch Pw
OFS
WIDTH
REFERENCE
CNTR
WIDTH
MEAS
OFF


: Set the parameter


MODE
N%
RATIO
99.5%
MEAS
OFF


ANT
M301
MEAS
OFF

(2 /2)



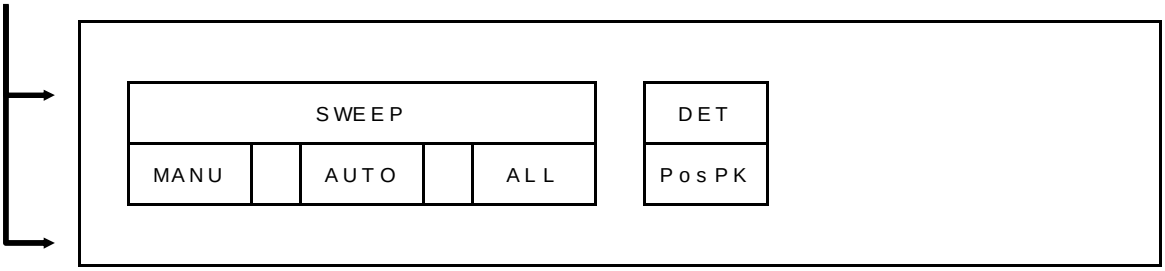
? Refer to “16. Calculation Function” to details

: Set the number

? Refer to “16. Display Scale” to details

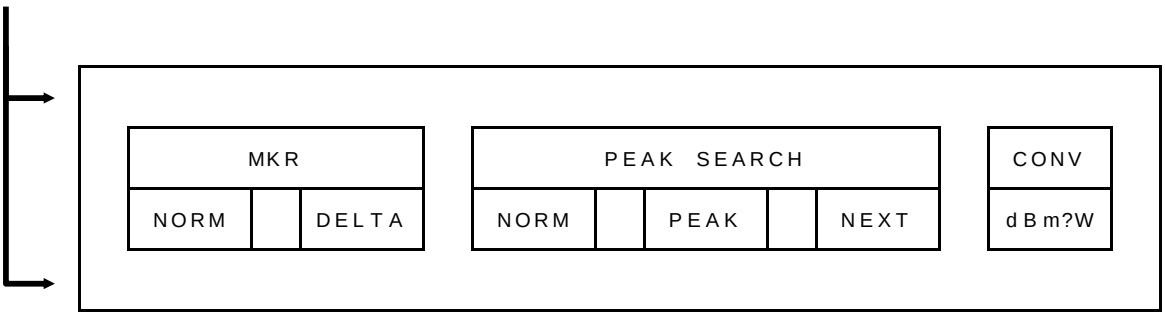
: Set the display scale

? Refer to “13. Sweep Axis· Detection Mode” to details



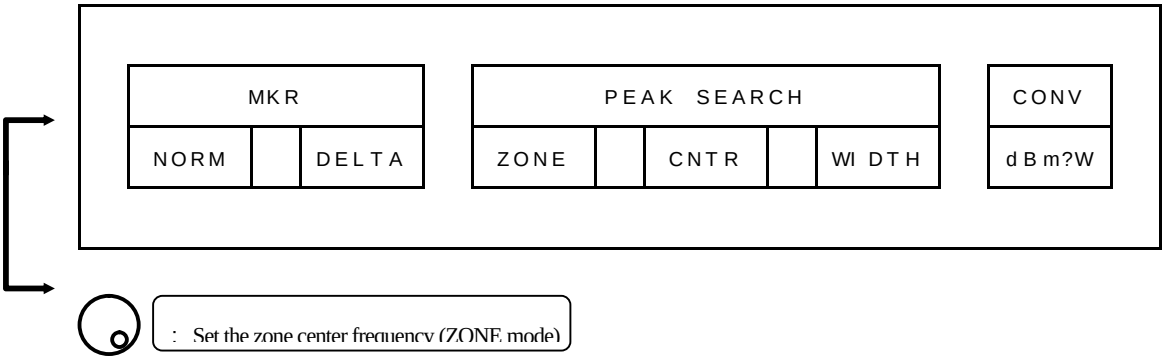
· Set the sweep time

? Refer to “17. Marker· Peak Search” to details



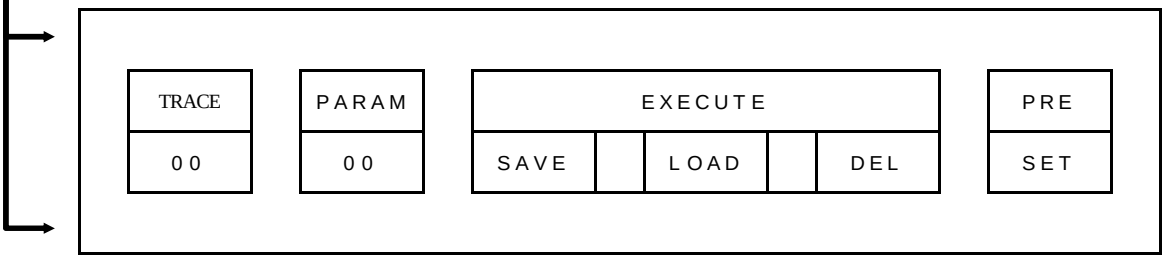
: Move the marker position (NORM mode)

F3: Changing the marker mode



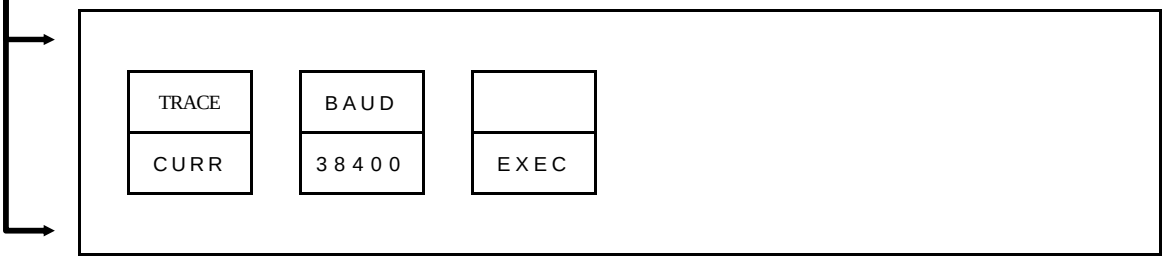
: Set the zone center frequency (ZONE mode)

? Refer to "18. Save/Load" to details



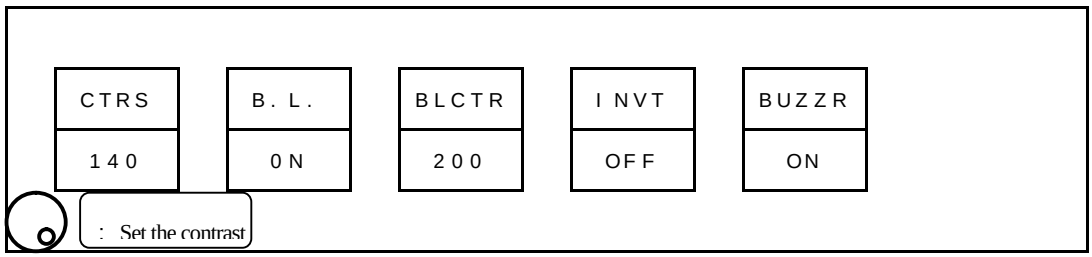
: Set the address to store the trace

? Refer to "22. Data Output" to details



: Set the trace to transfer

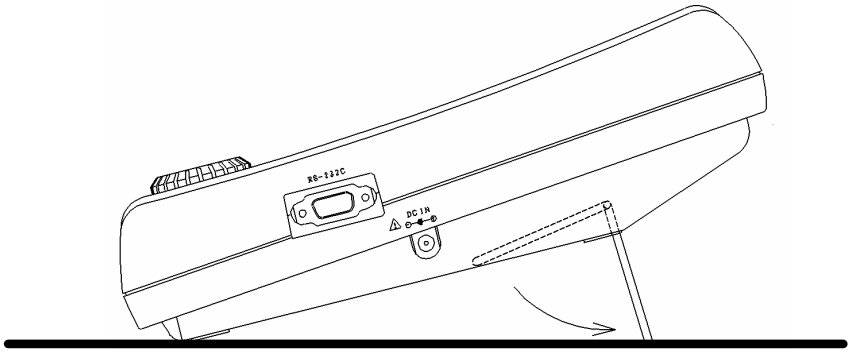
? Refer to “20. Screen Control” to details



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.

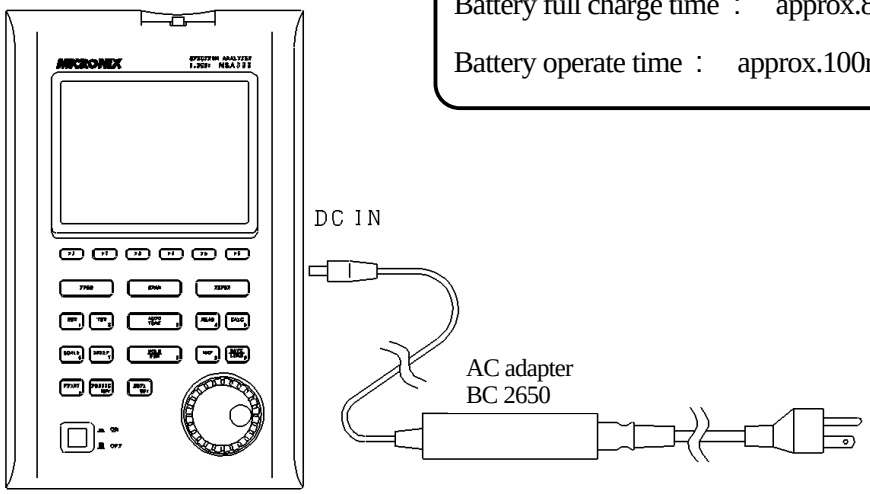


6．2 Connection to power supply

The BC 2650 AC adapter is both for the use with AC power supply and for charging the BP 2650 built-in battery. 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 BC 2650 supplied with the unit. Using an AC adapter other than the BC 2650 may cause damage to the unit.

Battery full charge time ： approx.8hours

Battery operate time ： approx.100minutes(back light OFF)



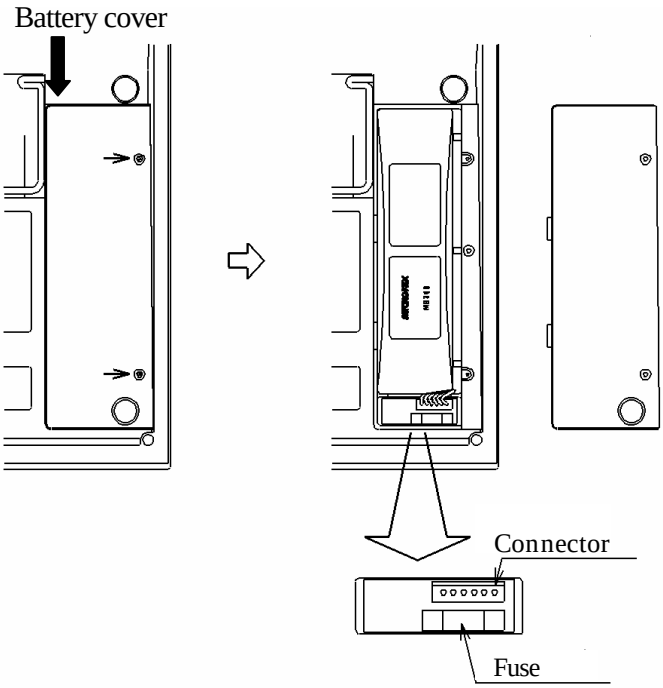
6．3 Replacing the fuse

5A/250V fuse (slow-blow type) is used for the battery power supply. When replacing it, turn the power off first, disconnect the AC adapter, remove the battery cover and on the back as shown in the figure below, remove the battery, and then take sufficient care to perform the replacement.

Be sure to use the fuse supplied with the unit, or specified one.

6．4 Installing the battery

When installing the battery, turn the power off first, disconnect the AC adapter, open the battery cover on the back of the unit after removing the two screws as shown in the figure below, and then take sufficient care to perform the installation. Be sure to use the specified battery, BP 2650.



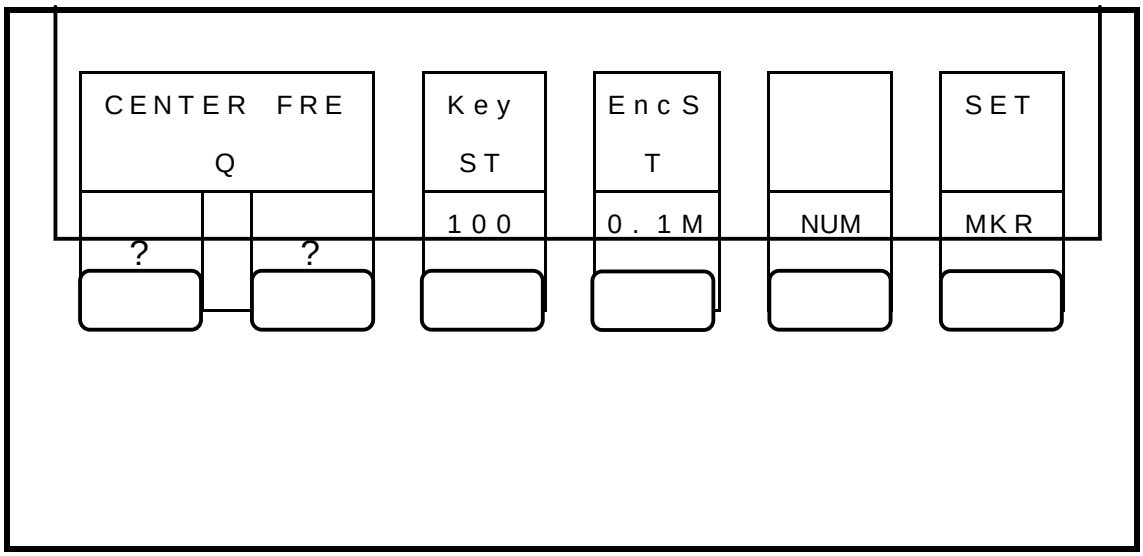
6．5 Soft carrying case

When carrying the unit or using it outdoors, the soft carrying case is convenient. You can also carry the AC adapter and printer with it, putting them in the accessory pouch.

? Avoid using the unit in the soft carrying case in places where temperature is high because, with the soft carrying case, the temperature inside becomes higher than the ambient temperature.

7． Center Frequency <FREQ>

Press [ ] to switch over to the function screen shown below:



Center frequency can be set between 0 to 3.3GHz.

7．1 Setting with the step keys (? F1? ,? F2?)

1．Each time [ ] is pressed, the center frequency decreases in the set step size.

2．Each time [ ] is pressed, the center frequency increases in the set step size.

3．Setting the step size:

Each time [ ] is pressed, it is set in the following order:

→ 0．1MHz → 1 MHz → 10MHz → 100MHz

7．2 Setting with the encoder

1．When is turned, the center frequency changes in the set step size.

2．Setting the step size:

Each [ ] is pressed, it is set in the following order:

→ 0．1MHz → 1 MHz → 10MHz → 100MHz

7．3 Setting with the numeric keys

1． Press [ ] to enter into the numeric key input mode.

? ? F5? functions as the < CLEAR> key. ? F6? functions as the < BACK SPACE> key.

? In this mode, setting with ? F1? , ? F2? or the encoder is not accepted.

2． The center frequency can be directly input according to the “Numeric Key Mapping Diagram”.

3． The value is entered by pressing a unit key, ? MHz (RS232C)? or ? GHz (DSPL)? .

? Any figures below the resolution (100 kHz) will be discarded.

4． Changing the setting:

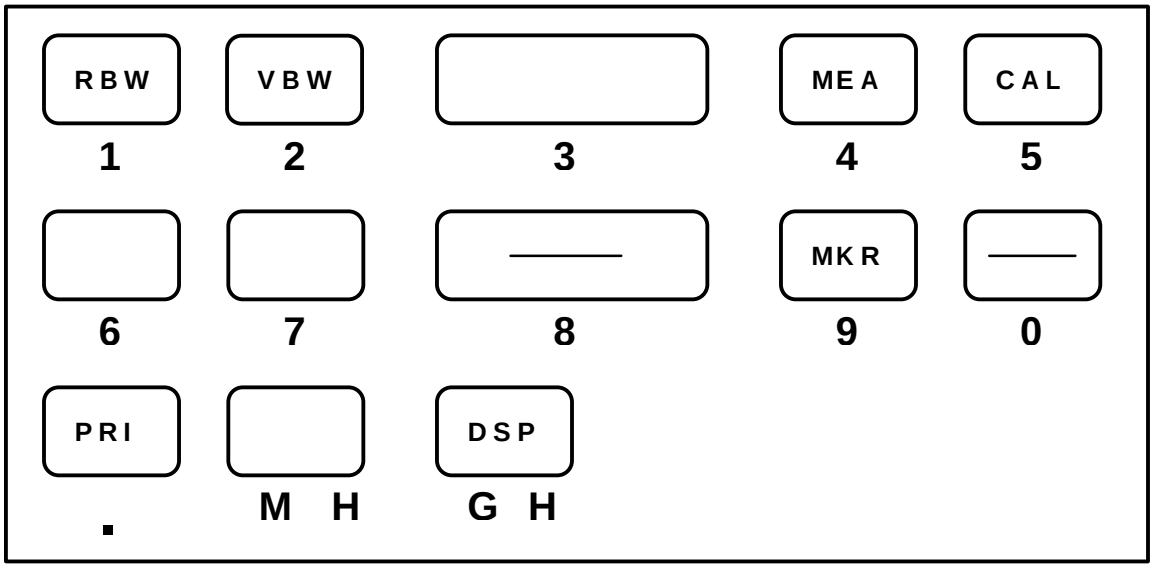
[ ] : Deletes the entire value and allows you to input one from the beginning.

[ ] : Deletes the last input figure.

5． Canceling the numeric key mode:

[FREO] : Enables setting with step keys(? F1? ,? F2?) or the encoder again.

“Numeric Key Mapping Diagram”



7．4 According to the Marker position

1． When [ ] is pressed, the center frequency is set according to the frequency of current marker position.

? Any figures below the resolution (100 kHz) will be discarded.

? This does not operate when the marker is not displayed. (and the function display disappears.)

8． Frequency Span <SPAN>

Press [ ] → [ ] use to set the frequency span.

? The frequency span can be set only with the encoder. Function keys are not available.

1． When [ ] is turned, the frequency span changes in the specified step.

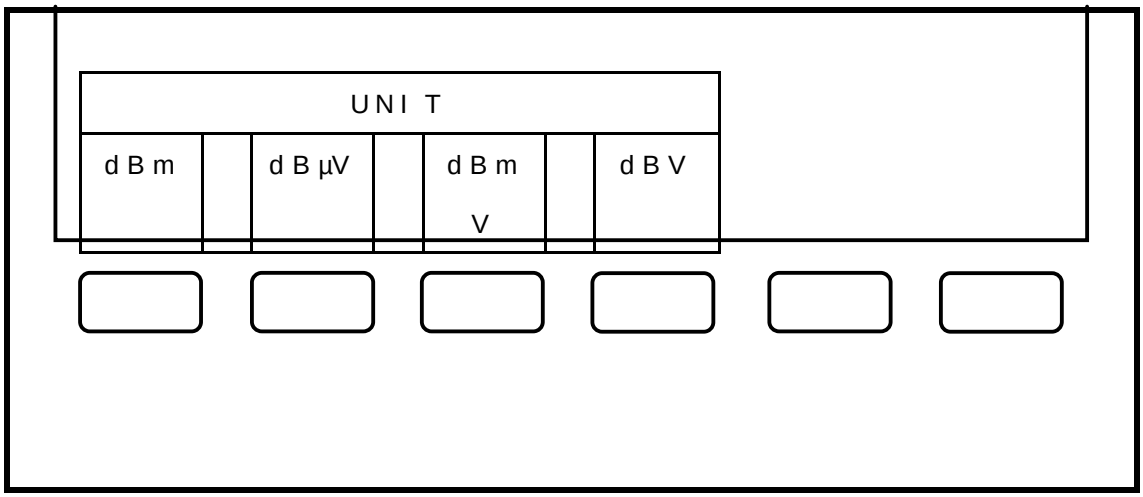
ZERO ⟷ 200k ⟷ 500k ⟷ 1M ⟷ 2M ⟷ 5M ⟷ 10M

20M ⟷ 50M ⟷ 100M ⟷ 500M ⟷ 1G ⟷ 2G

FULL(3.3G)

9． Reference Level <REFER>

Press [ ] to switch over to the function screen shown below:



9．1 Setting the Reference level

1． When [ ] is turned, the reference level changes.

(Refer to “9.3 Reference level setting range for each unit” for details.)

9．2 Switching units of amplitude axis (dBμV/m and dBμA/m are optional. Refer to “19.4 Electric field strength measurement” and “19.5 Magnetic field strength measurement” for details.)

1． Press [ ] to switching units to dBm.

Press [ ] to switching units to dBμV

Press [ ] to switching units to dBmV

Press [ ] to switching units to dBV

9．3 Reference level setting range for each unit

UNIT	dBm	dBμV	dBmV	dBV
MAXIMUM	10	117	57	-3
MINIMUM	-40	67	7	-53

“Unit that is able to use it with the measuring function”

UNIT	dBμV/m (Electric filed strength measurement)				dBμA/m (Magnetic field strength measurement)
Setting	AN301	AN302	AN303	AN304	PR 26M
MAXIMUM	146	150	153	154	159 to 178
MINIMUM	96	100	103	104	109 to 128

Calculation expression (conversion formula to and from dBm)

? X[dBm]=107+X[dBμV] ? B[dBm]=47+B[dBmV] ? C[dBm]=-13+C[dBV]

? Y[dBm]=68.8/?×√(Y/Gar)[dBμV/m] ?: Wavelength[m] Gar: Antenna absolute gain

? Z[dBm]=180+Z+A[dBμA/m] A: probe calibration coefficient ? changes by frequency

9．4 Relation between the reference level and ATT･ AMP (in dBm indication)

The programmable attenuator (ATT) and the reference amplifier (AMP) inside 2650 are automatically set according to the setting value of the reference level (REFER). (ATT 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

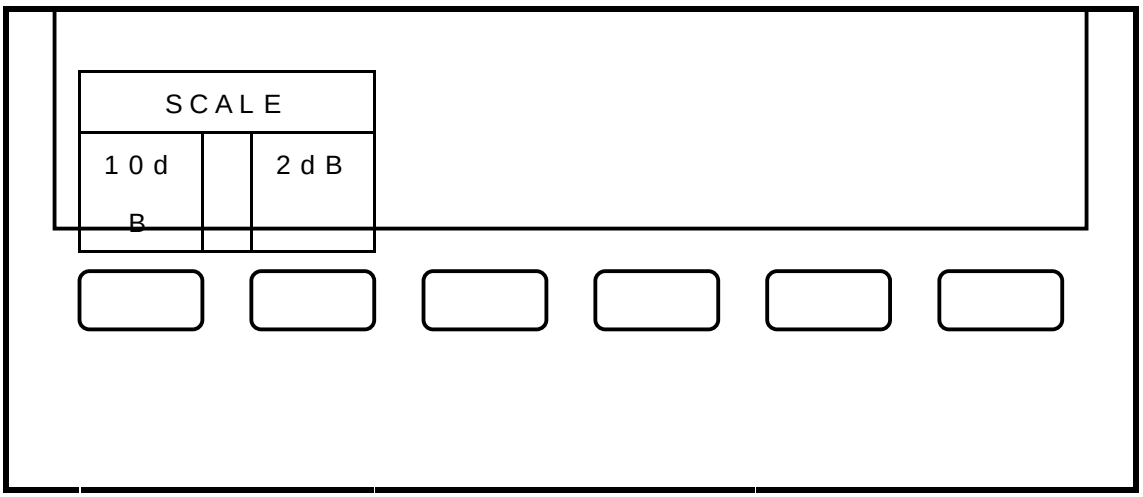
REFER(dBm)	ATT (dB)	AMP (dB)
-3	12	0
-4	11	0
-5	10	0
-6	9	0
-7	8	0
-8	7	0
-9	6	0
-10	5	0
-11	4	0
-12	3	0
-13	2	0
-14	1	0
-15	0	0

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

REFER (dBm)	ATT (dB)	AMP (dB)
-29	9	28
-30	8	28
-31	7	28
-32	6	28
-33	5	28
-34	4	28
-35	3	28
-36	7	28
-37	6	28
-38	5	28
-39	4	28
-40	3	28

10. Display Scale <SCALE>

Press [ ] to switch over to the function screen shown below:



10.1 Setting with the keys (? F1? ,? F2?)

1. Press [ ] to set the 10dB/div display scale.
2. Press [ ] to set the 2dB/div display scale.

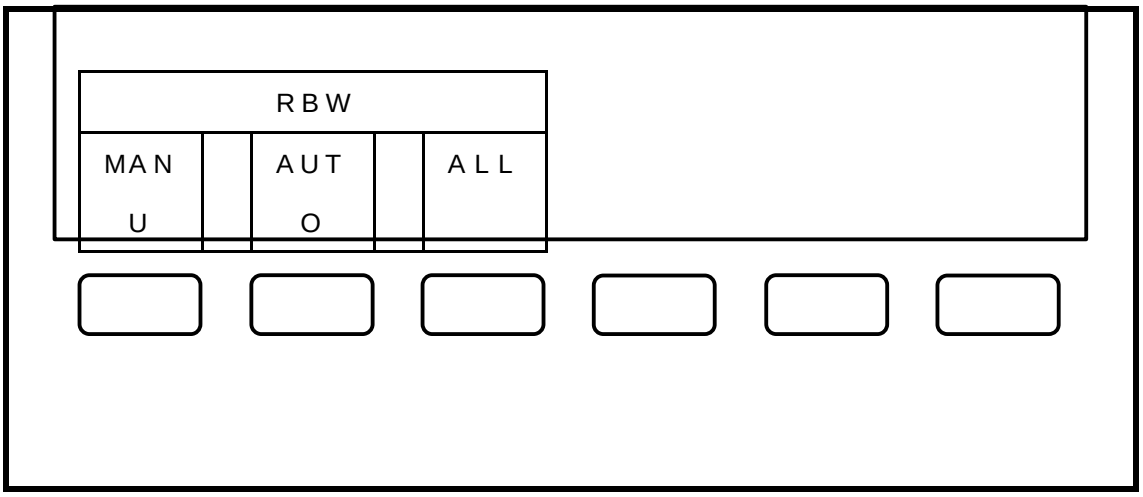
10.2 Setting with the encoder

1. Turn [ ] to switch between the 10dB/div and 2dB/div display scale.

10dB ⟷ 2dB

11. Resolution Bandwidth <RBW>

Press [ ] to switch over to the function screen shown below:



11.1 MANUAL mode

1. s f1 or turn the to enter MANUAL mode. Use to set the RBW.

3kHz ⟷ 10kHz ⟷ 30kHz ⟷ 100kHz ⟷ 300kHz

1MHz 3MHz

11.2 AUTO mode

1. When is pressed, optimum RBW is set according to the settings of SPAN and SWEEP.

? When the AUTO mode is set, it can be confirmed by the asterisk (*) that is displayed on the right end of the RBW setting value display area on the screen.

11.3 ALL AUTO mode

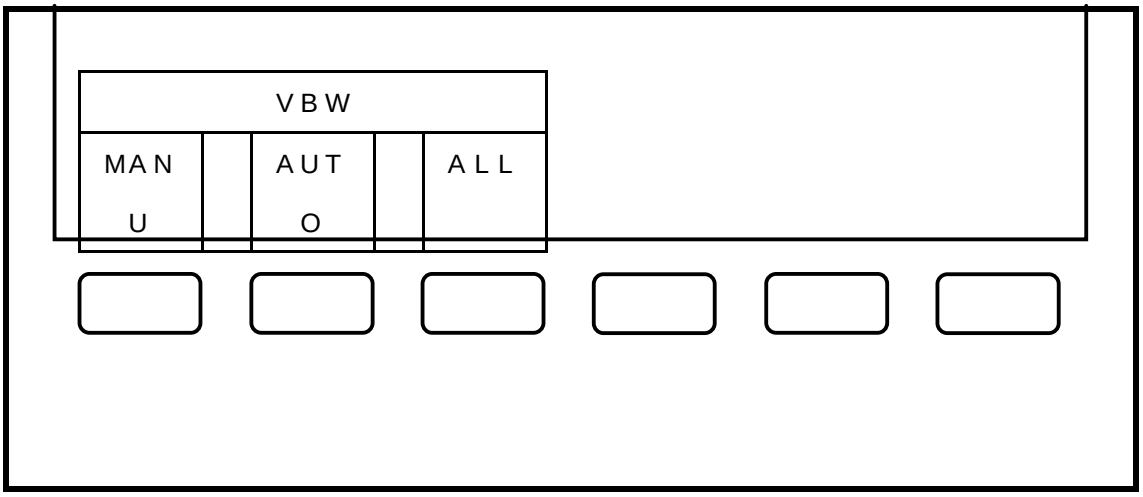
1. n is pressed, optimum RBW, VBW and SWEEP are set according to the setting of SPAN.

? When the ALL AUTO mode is set, it can be confirmed by the asterisk (*) that is displayed on the right end of the RBW, VBW and SWEEP setting value display area on the screen.

? Selectivity(-60dBc width) becomes bigger than actual values by SSB phase noise when 3kHz and 10kHz.

12. Video Bandwidth <VBW>

Press to switch over to the function screen shown below:



12．1 MANUAL mode

1． Press [ ] or turn the to enter MANUAL mode. Use to set the VBW.

100Hz ⟷ 300Hz ⟷ 1kHz ⟷ 3kHz ⟷ 10kHz 30kHz

100kHz ⟷ 300kHz OFF

12．2 AUTO mode

1． When [ ] is pressed, VBW is set according to the settings of SPAN and SWEEP.

? When the AUTO mode is set, it can be confirmed by the asterisk (*) that is displayed on the right end of the VBW setting value display area on the screen.

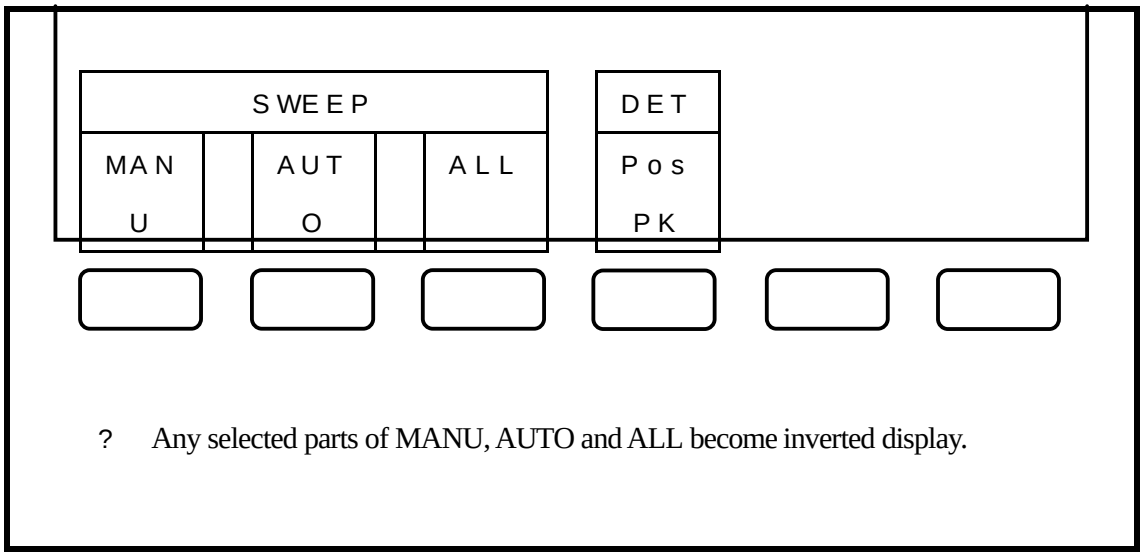
12．3 ALL AUTO mode

1． When [ ] is pressed, RBW, VBW and SWEEP are set according to the setting of SPAN.

? When the ALL AUTO mode is set, it can be confirmed by the asterisk (*) that is displayed on the right end of the RBW, VBW and SWEEP setting value display area on the screen.

13． Sweep Axis･ Detection Mode <SWEEP>

Press [ ] to switch over to the function screen shown below:



? Any selected parts of MANU, AUTO and ALL become inverted display.

13.1 MANUAL mode

1. Press f1 or turn the to enter MANUAL mode. Use to set the SWEEP.

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

? Can't set 10ms at the FULLSPAN.

13.2 AUTO mode

1. When is pressed, SWEEP is set according to the settings of SPAN and RBW.

? When the AUTO mode is set, it can be confirmed by the asterisk (*) that is displayed on the right end of the SWEEP setting value display area on the screen.

13.3 ALL AUTO mode

1. is pressed, RBW, VBW and SWEEP are set according to the setting of SPAN.

? When the ALL AUTO mode is set, it can be confirmed by the asterisk (*) that is displayed on the right end of the RBW, VBW and SWEEP setting value display area on the screen.

13.4 Setting the Detection mode

Pressing allows you to change the method to capture the trace.

?PosPK (Positive Peak) : Traces the maximum value of the sample points.

?SMPL (Sample) : Traces the momentary value of the sample points.

?NegPK(Negative Peak) : Traces the minimum value of the sample points.

? When sweep time is 10ms or 30ms, only SMPL is able to set up.

14. AUTO Tuning <AUTO TUNE>

When [ ] is pressed, the peak spectrum of the input signal is searched and centered on the screen, and optimum RBW, VBW and SWEEP are set according to the setting of SPAN.

- ? Please set up frequency span before auto tuning.
- ? This operates only with the key pad, with no function indication.
- ? This does not operate normally when the signal level is -40 dBm or lower, the input frequency is 50 MHz or lower, or the frequency span is ZERO SPAN or FULL SPAN.

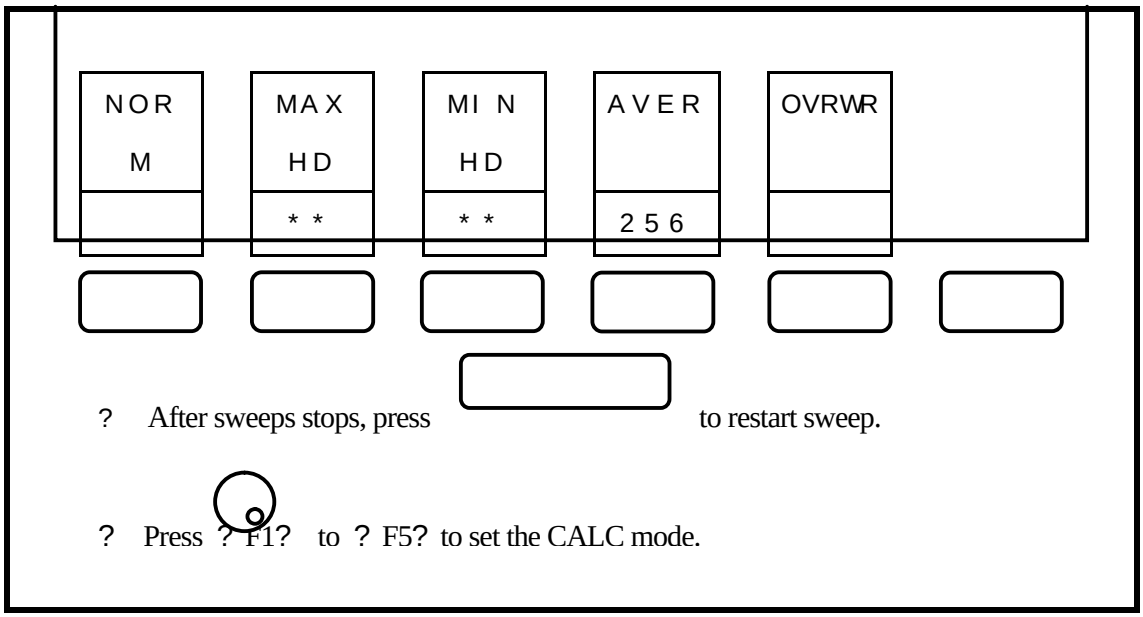
15. Hold/Run <HOLD/RUN>

Press [ ] to switch to between sweep halt and continuous sweep.

- ? This operates only with the key press, with no function indication.

16. Calculation Function <CALC>

Press [ ] to switch over to the function screen shown below:



- ? After sweeps stops, press [ ] to restart sweep.
- ? Press ? F1? to ? F5? to set the CALC mode.

16.1 NORM mode

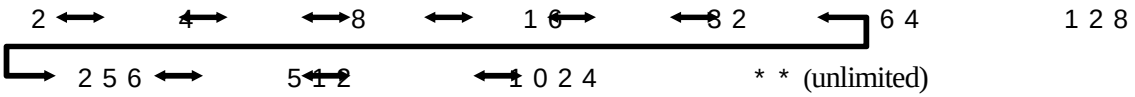
1. Press [ ]. Calculation is not performed in this mode. The number of sweeps is always unlimited.

? "NORMAL" is displayed in the CALC area on the LCD screen.

(Refer to "4. Description Of Display" for details)

16.2 MAX HOLD mode

1. Press [ ] → Use ◯ to set the number of sweeps.
2. Sweeps are performed the set number of times, the maximum value of each point of trace data is displayed as a trace, and then sweep is halted.

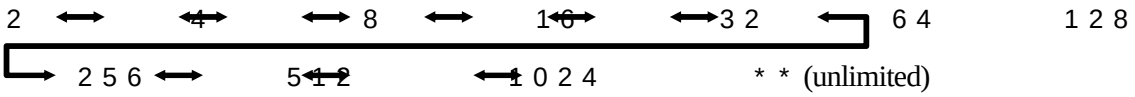


? "MAX --- (number of sweeps)" is displayed in the CALC area on the LCD screen.

(Refer to "4. Description Of Display" for details)

16.3 MIN HOLD mode

1. Press [ ] → ◯ Use to set the number of sweeps.
2. Sweeps are performed the set number of times, the minimum value of each point of trace data is displayed as a trace, and then sweep is halted.

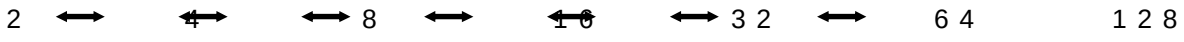


? "MIN --- (number of sweeps)" is displayed in the CALC area on the LCD screen.

(Refer to "4. Description Of Display" for details)

16.4 AVERAGE mode

1. Press [ ] → ◯ Use to set the number of sweeps.
2. Sweeps are performed the set number of times, average value of each point of trace data is displayed as a trace, and then sweep is halted.



256

? “AVG --- (number of sweeps)” is displayed in the CALC area on the LCD screen.

(Refer to “4. Description Of Display” for details)

16.5 OVER WRITE mode

1. [ ] to enter into the OVER WRITE mode, where traces are written one over another. The number of sweeps is unlimited.

? “OVER WR” is displayed in the CALC area on the LCD screen.

(Refer to “4. Description Of Display” for details)

? Only the last one trace is saved.

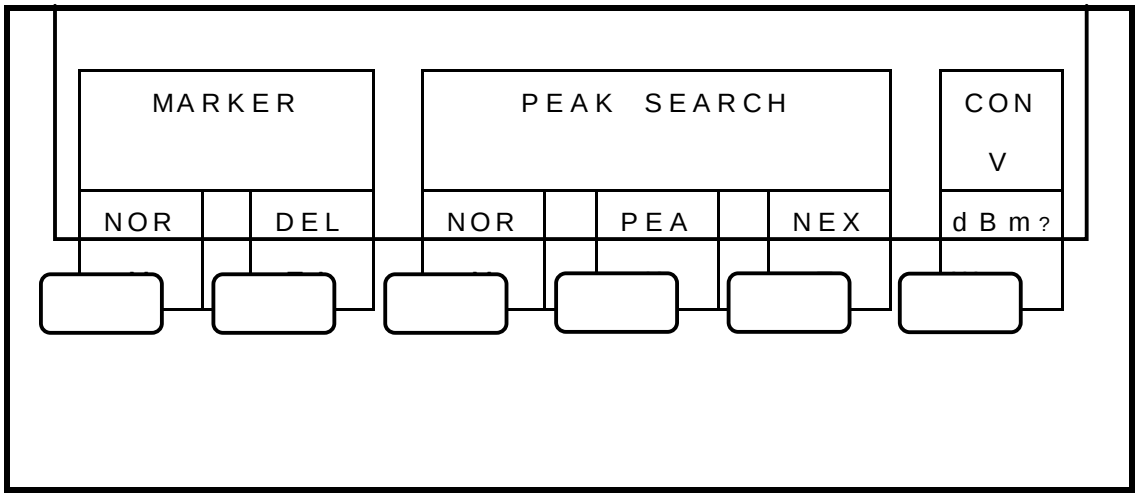
17. Marker· Peak Search <MKR>

Press [ ] to switch over to the function screen shown below:

?The display when a NORM marker is selected.

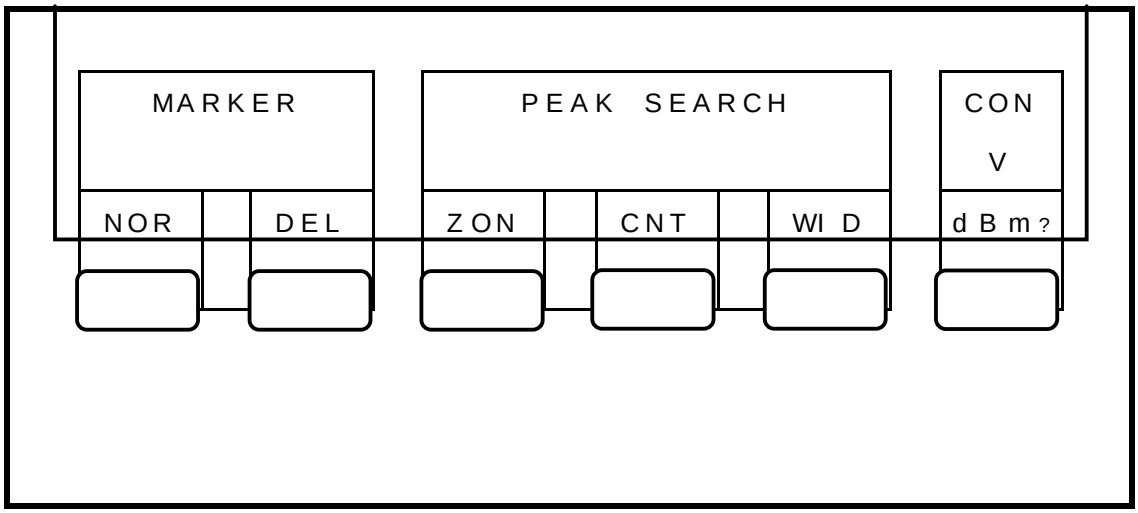
The marker is manually moved at NORM mode. Peak search function, NEXT peak search function are available.

? The



display when a ZONE marker is selected.

The marker moves to the biggest peak position automatically at ZONE mode, inside specified zone.



1 7 . **1**

Moving the marker

Use → to move the marker.

Use to put DELTA REF at the current marker position.

1 7 . 2 Setting the peak search <PEAK SEARCH>

? NORM mode (Use to select NORM.)

Use to move the marker to the maximum peak position.

Use to move the marker successively from higher to lower peak positions other than the maximum peak. (The marker moves to 10 peaks.)

? When you move the marker to the 10th peak or moving the marker, the NEXT peak search function stops and the function display disappears.

? ZONE mode (Use to select ZONE.)

Use → to move the center position.

Use → to change the width.

1 7 . 3 Changing the unit of marker point

Press to change the unit of marker point.

When unit of reference level is dBm, the unit is changed from [dBm] to [W].

When unit of reference level is dBµV, the unit is changed from [dBµV] to [V].

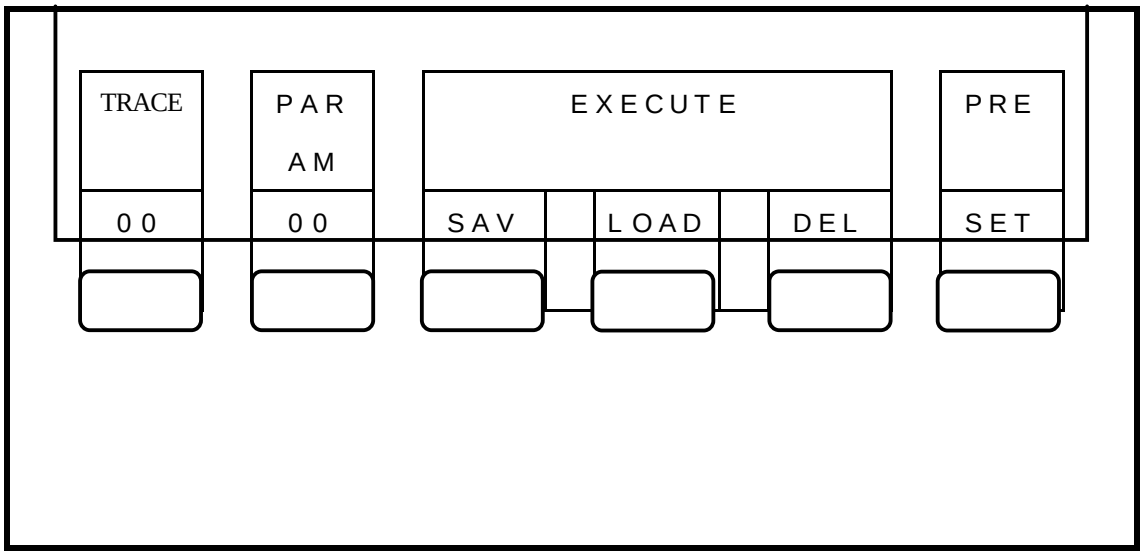
When unit of reference level is dBmV, the unit is changed from [dBmV] to [V].

When unit of reference level is dBV, the unit is changed from [dBV] to [V].

When unit of reference level is dBμV/m, the unit is changed from [dBμV/m] to [V/m].

18. Save/Load <SAVE/LOAD>

Press [ ] to switch over to the function screen shown below:



18.1 [ ]

Setting the location to store the trace

1. Pressing allows you to set the number of location to store the trace.
2. Use to set the number of location.

   00 ⟷ 01 ⟷ 02 ⟷ 03 ⟷ 04 ⟷ ... 98 99

   ? The part of TRACE become inverted display after it is selected.

18.2 Setting location to store the parameter [ ]

1. Pressing allows you to set the number of location to store the parameter.
2. Use to set the number of location.

   00 ⟷ 01 ⟷ 02 ⟷ 03 ⟷ 04 ⟷ ... 98 99

   ? The part of PARAM become inverted display after it is selected.

18.3 Saving the data

1. Press [ ] to save the data at the set number.

? This saves the trace when TRACE is selected, or the setting parameters when PARAM is selected.

? When data is saved, it can be confirmed by the asterisk (*) that is displayed on the right end of the number.

? It can be overwritten, too

18.4 Loading the data

1. Press [ ] to read out the data at the set number.

? This reads out the trace when TRACE is selected. The setting parameter of the loaded trace is displayed in the loaded trace information display area.

(Refer to "4. Description Of Display" for details)

? This reads out the setting parameters when PARAM is selected.

? When you load a trace, the current trace disappears, the HOLD state is set, and the loaded trace is displayed. For the loaded trace, you can use the marker, but cannot use a measuring function. When you press the HOLD/RUN key, the loaded and the current traces are displayed overlapping each other.

? When data is saved, it can be confirmed by the asterisk (*) that is displayed on the right end of the number.

? When you search the trace or setting parameters to be read out, repeat [ ] ↔ [ ] ↔ [ ] . . . , and load the trace or setting parameters in turn.

18.5 Clearing the loaded trace

1. [ ] to clear the loaded trace that has been displayed.

18.6 Presetting (Initialization)

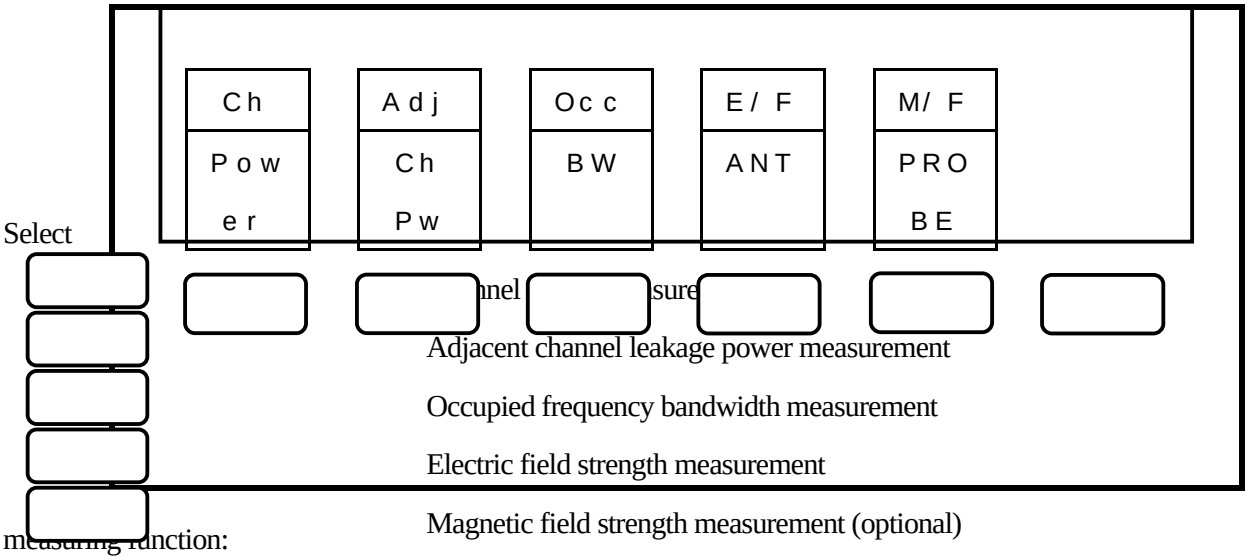
1. [ ] to preset the setting parameters as the Initialization shown below:

"Initialization"

Setting Item	Setting parameter
Center frequency	1GHz
Frequency span	20MHz
Reference level	10dBm
Sweep time	0.3s
Detection mode	Positive peak mode
RBW	300kHz
VBW	OFF
Display scale	10dB/div

19. Measuring Function<MEAS>

Press [ ] to switch over to the function screen shown below:



Select the measuring function:

Adjacent channel leakage power measurement

Occupied frequency bandwidth measurement

Electric field strength measurement

Magnetic field strength measurement (optional)

Ch Power · · · · · · ·

Adj Ch Pw · · · · · · ·

Occ BW · · · · · · · · ·

E/F ANT · · · · · · · ·

M/F PROBE · · · ·

? Once you select the measuring function, pressing [ ] next time will directly bring up the function screen for the function you selected the last time. If you want to stop the measuring function, or if you want to select another measuring function, press [F6] (MEAS OFF). This stops the measuring function and switches to the above screen, which allows you to select the measuring function.

? The measuring function is stops, when push [ ] while these 3 functions (Channel power measurement, Adjacent channel leakage power measurement, Occupied frequency bandwidth measurement) are selected. Because these 3 functions and marker are not able to implement it simultaneously. Similarly, the function of the marker stops, when the functions of these 3 measurements are selected while using the marker.

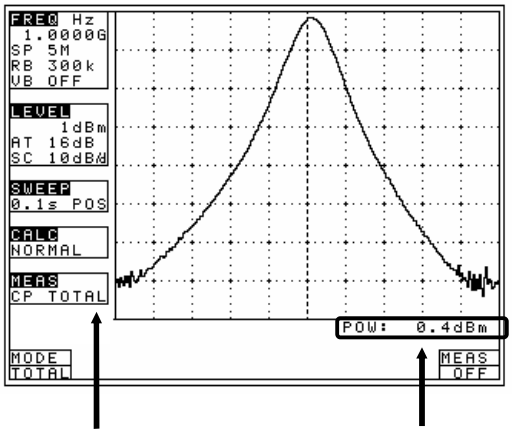
? The unit displays data in 251 horizontal dots, but it internally captures the trace and calculates the measured value (Channel power measurement, Adjacent channel leakage power measurement and Occupied frequency bandwidth measurement) in 1001 dots.

19.1 Channel power measurement <Ch Power> [ ]

Measures the sum of the power in the zone specified. Two modes, TOTAL and BAND, are available.

? TOTAL mode? Use [ ] (MODE) to select TOTAL.?

Measure the sum of the power in the zone specified by the center frequency and frequency span (whole range of the screen).



[Channel power measurement mode]

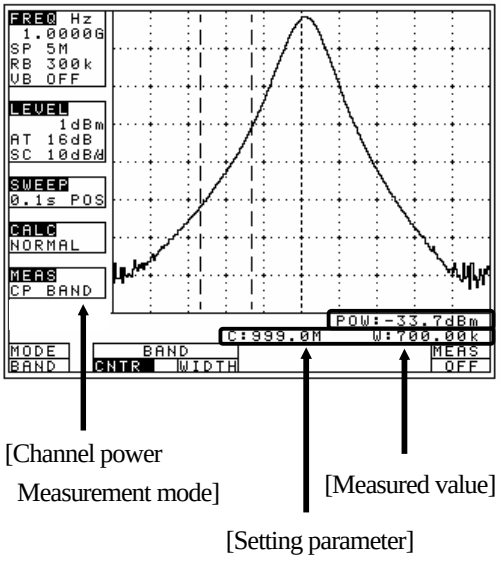
[Measured value]

? It is shown on MEAS area of LCD as “CP TOTAL”

? The measured value is displayed at the right lower corner on the screen.

? BAND mode? Use (MODE) to select BAND.?

Measure the sum of the power in the zone specified by the zone center frequency and zone width.



? It is shown on MEAS area of LCD as “CP BAND”.

? The measured value and setting parameter are displayed at the right lower corner on the screen.

1.Use (CNTR) to set the zone center frequency.

2.Use (WIDTH) to set the zone width.

19．2 Adjacent channel leakage power measurement <Adj Ch Pw>

Measures the adjacent channel leakage power as the ratio of the power in the range specified by the offset frequency against the reference frequency (reference carrier frequency) and the bandwidth, to the carrier wave power. Two channels of adjacent waves on the upper and lower sides of the same offset frequency are measured. In addition, you can select from three modes, TOTAL (total power method), REF BAND (in-band method) and PEAK (reference level method), according to the classification of definitions of carrier wave.

? Mode selection and measurement? Use (MODE) to select a mode: TOTAL, BAND or PEAK.?

? It is each shown on MEAS area of LCD as “ACP TOT”, “ACP BAND” or “ACP PK”.

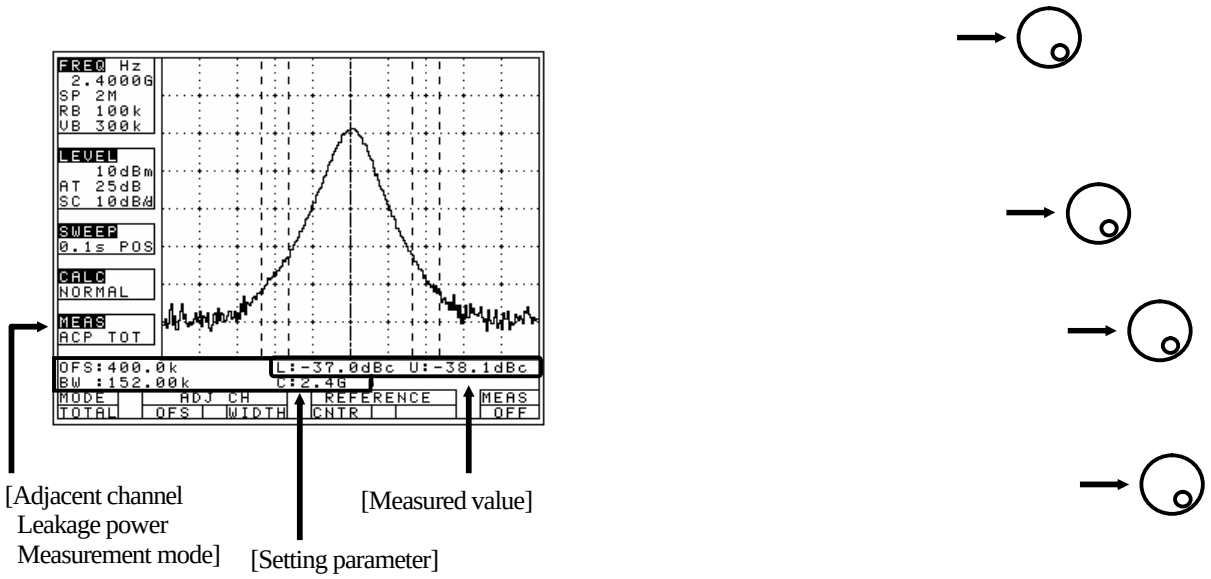
? The measured value and setting parameter are displayed at the right lower corner on the screen.

1.Use (Adj Ch OFS) to set the offset frequency of adjacent channel.

? The offset is from the center of the reference carrier wave.

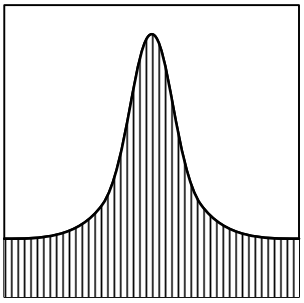
2.Use (Adj Ch WIDTH) to set the bandwidth of adjacent channel.

3.Use (REFERENCE CNTR) to set the center frequency of reference carrier



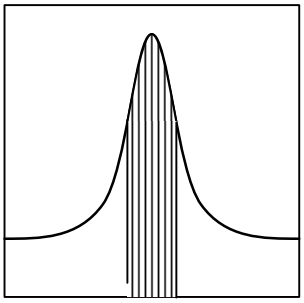
? Definition of the reference carrier for each mode

T O T A L (total power method)



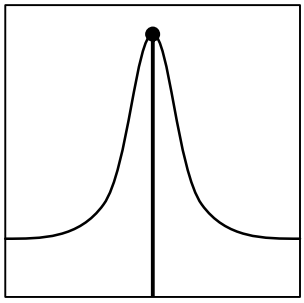
This is based on the sum total of the power of whole range on the screen. Use [F4] to set center frequency of the reference carrier wave.

B A N D (in-band method)



This is based on the sum total of the power within the set bandwidth. Use [F4] to set center frequency of the reference carrier wave.

P E A K (reference level method)



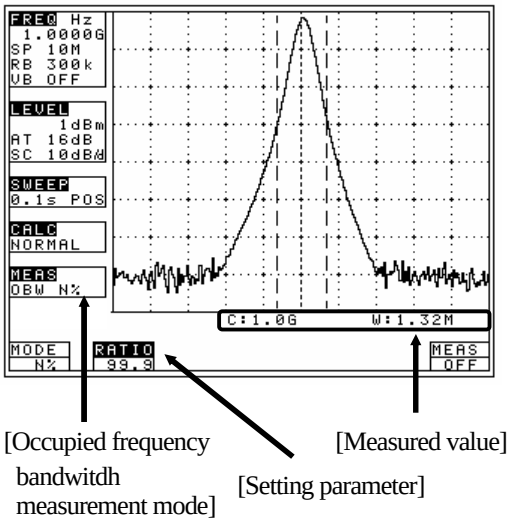
This is based on the power of the peak on the screen. Center frequency of the reference carrier wave is set up to the peak inside the screen automatically.

1 9 . 3 Occupied frequency bandwidth measurement <Occ BW>

Measures the bandwidth at the point of N [%] of total power (N% POWER) or the bandwidth at the point X [dB] down from the peak level (XdB DOWN). Two modes are available.

? N% POWER mode? Use (MODE) to select N%.?

Measures the bandwidth at the point of N [%] of total power displayed on the screen.



[Occupied frequency bandwitdh measurement mode]

[Setting parameter]

[Measured value]

? It is shown on MEAS area of LCD as “OBW N%”

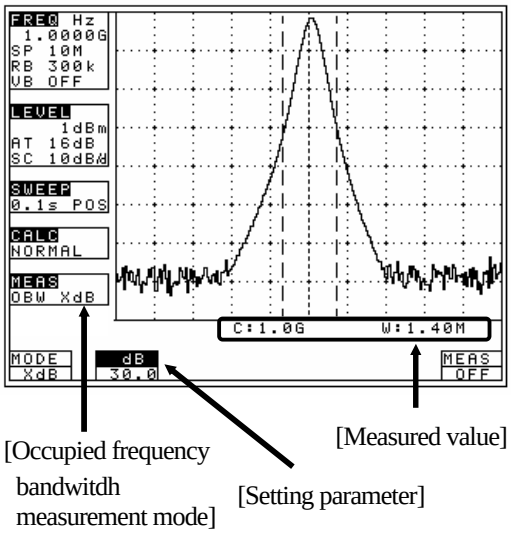
? The measured value is displayed at the right lower corner on the screen.

1.Use (RATIO) to set the percentage to total power.

? Setting range : 80.0 to 99.9%

? XdB DOWN mode? Use (MODE) to select XdB.?

Measures the bandwidth at the point X [dB] down from the peak level,



[Occupied frequency bandwitdh measurement mode]

[Setting parameter]

[Measured value]

? It is shown on MEAS area of LCD as “OBW XdB”

? The measured value is displayed at the right lower corner on the screen.

1.Use (dB) to set the down level from peak level.

? Setting range : 0.1 to 80.0dB

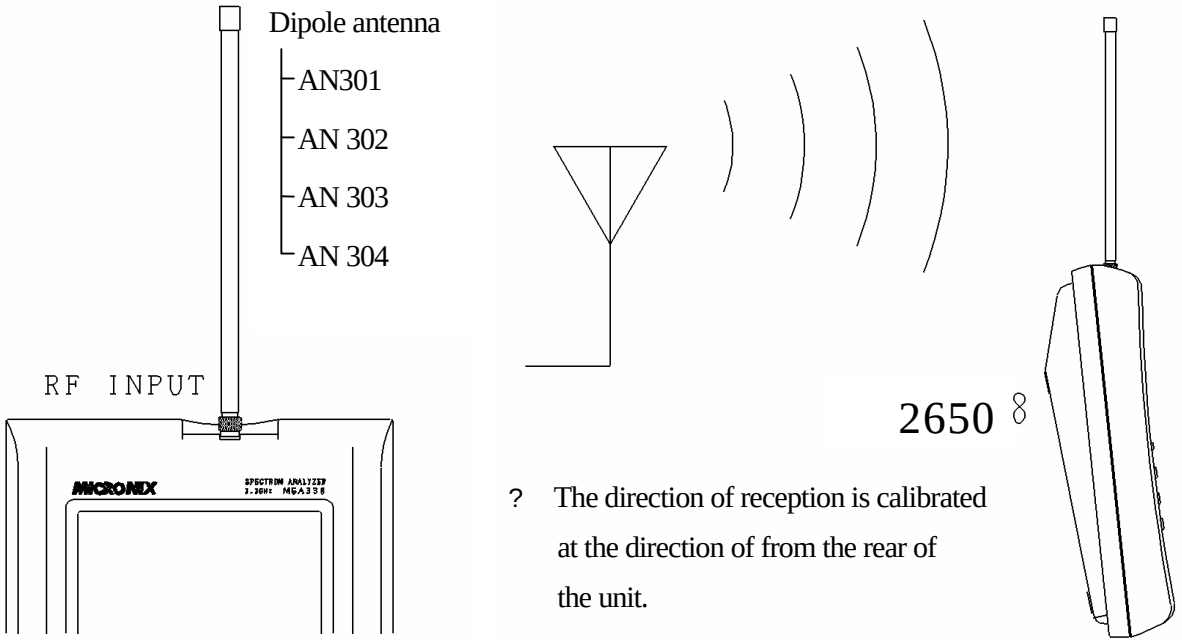
１９．４ Electric field strength measurement <E/F ANT>

Measures electric field strength by connecting an optional dipole antenna.

Allows using an antenna other than options by creating and inputting the original calibration table.

? Antenna connection?

? Measurement environment?



? The direction of reception is calibrated at the direction of from the rear of the unit.

"Specifications of the dipole (antenna gain and VSWR are specified at a center of frequency range)."

Items	AN 301	AN 302	AN 303	AN 304
Frequency range	0.8 to 1.0GHz	1.25 to 1.65GHz	1.70 to 2.20 GHz	2.25 to 2.65GHz
Antenna gain	+1dBi or higher	+1dBi or higher	+1dBi or higher	+1dBi or higher
VSWR	1.5 or lower	1.5 or lower	1.5 or lower	1.5 or lower
Dimensions	7.5f ×250mm	7.5f ×250mm	7.5f ×180mm	7.5f ×180mm
Weight	approx.20g	approx.20g	approx. 20g	approx.20g
Reference level setting range	96 to 146dBμV/m	100 to 150dBμV/m	103 to 153dBμV/m	104 to 154dBμV/m

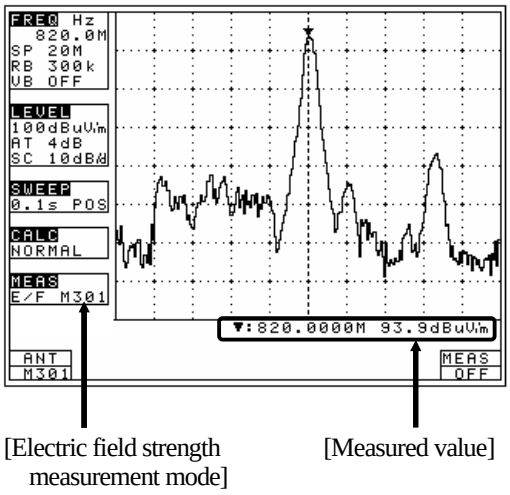
? Mode selection and measurement

(ANT) to select an antenna, AN 301, AN 302, AN 303, AN 304 or USER. As soon as the antenna is entered, the measurement is taken.

? It is each shown on MEAS area of LCD as “M/F AN 301”, “M/F AN 302”, “M/F AN 303”, “M/F AN 304” or “M/F USER”.

? “USER” is an original calibration table the user crates.

(Refer to “23.1 Command description” for details.)



[Electric field strength measurement mode]

[Measured value]

Unit of amplitude axis changes to [dBμV/m]

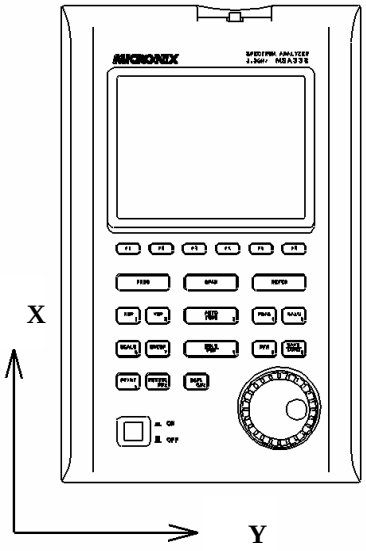
? Optimum center frequency and frequency span are set according to the antenna.
In addition, a trace is not displayed for frequencies outside those supported by the antenna.

(Example) case of AN 301

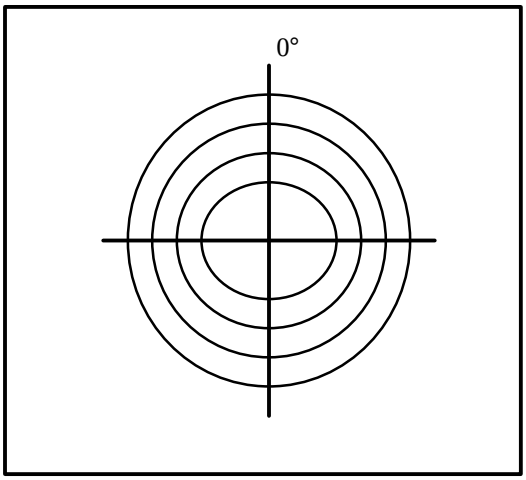
Center frequency: 900MHz

Frequency span : 200MHz

? Antenna directivity (reference data)



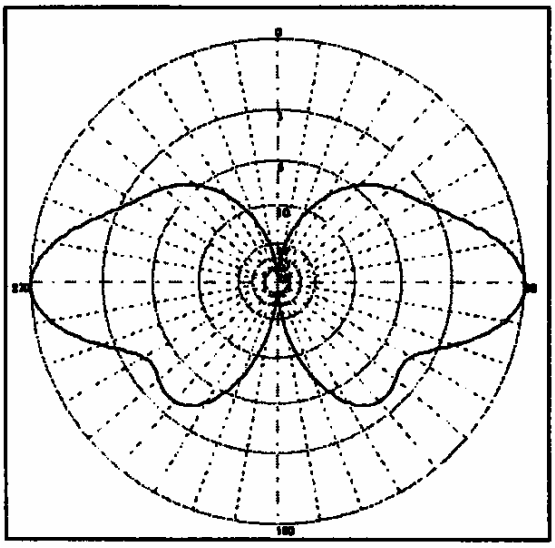
E plane : X-Y axis (X direction=0°)

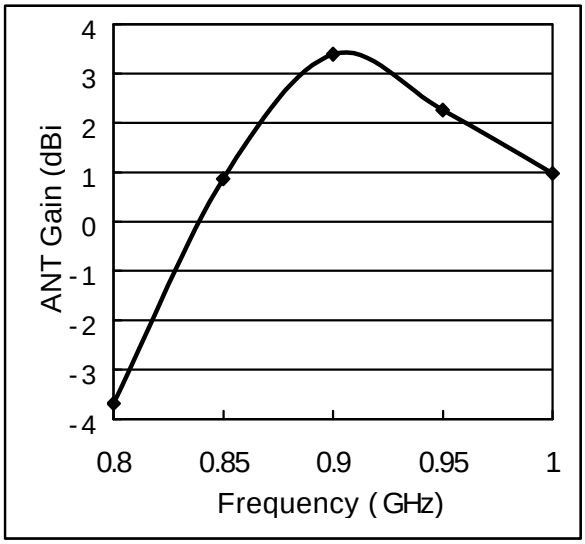


? All the data are those when the antenna is connected to the RF input with no obstacles around.

So, the directivity changes in practice, because, for example, the unit is carried by people.

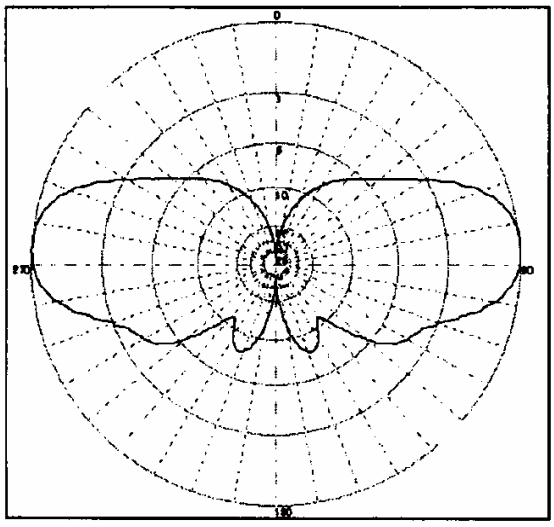
AN 301 (900MHz, E plane) Antenna gain vs. Frequency

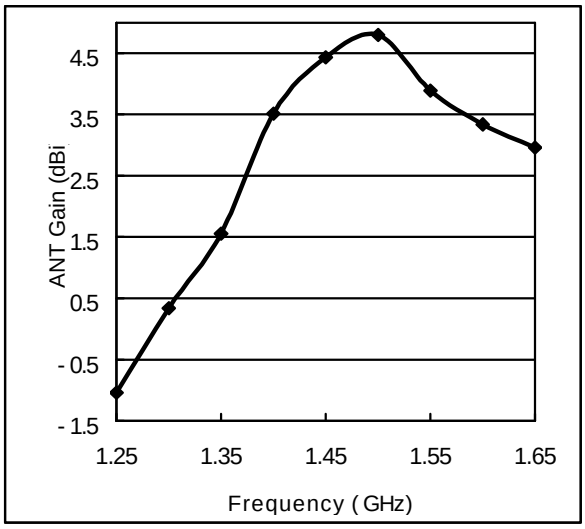




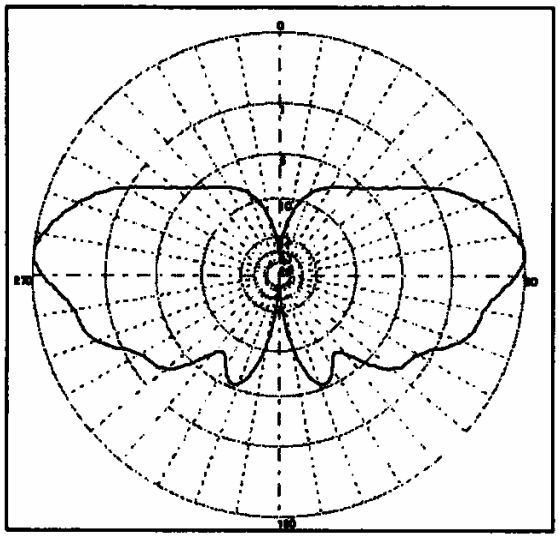
AN 302 (1.5GHz, E plane)

Antenna gain vs. Frequency

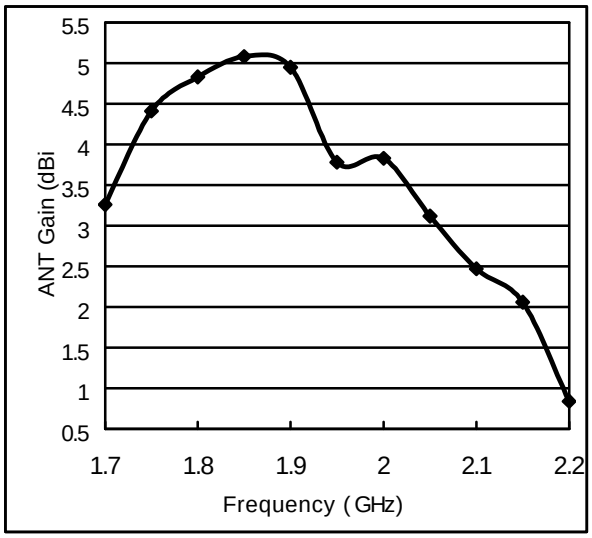




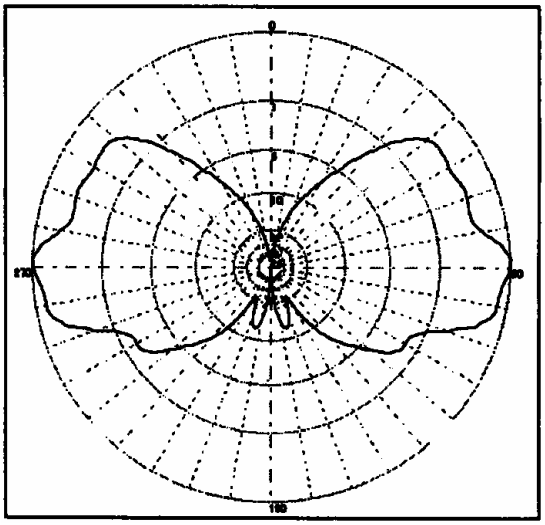
AN 303 (2.0GHz, E plane)



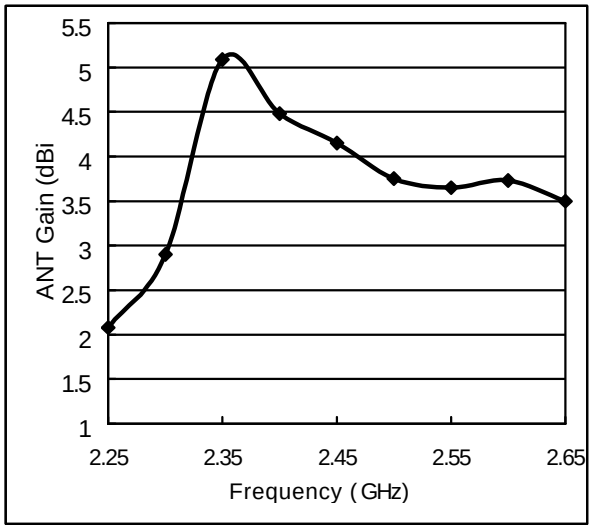
Antenna gain vs. Frequency



AN 304 (2.4GHz, E plane)

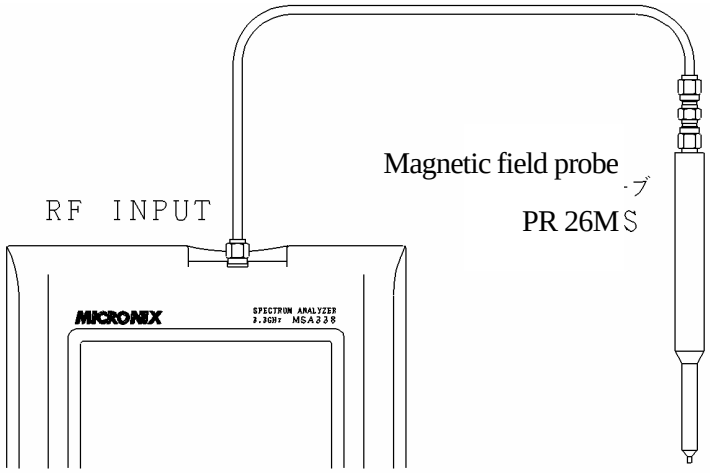


Antenna gain vs. Frequency



１９．５　Magnetic field strength measurement <M/F PROBE> (optional)

Measures the magnetic field strength using the optional magnetic field probe PR 26M.



"Specifications of magnetic field probe PR 26M"

Items	Specifications
Frequency range	10MHz to 3GHz
Space resolution	approx.0.25 mm (Depending on objects)
Dimensions	outside: 12f ×135mm probe tip: 2mm(W)×1mm(T)
Connector	SMA (P)
Reference level setting range (maximum)	159 to 178dBμA /m
Reference level setting range (minimum)	109 to 128dBμA /m
Measurement error	approx.±1dB (Measurement error of the instrument itself is not included.)

The tip of the optional magnetic field probe PR 26M 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.

(Refer to the operating manual for PR 26M for details.)

? Registration of the probe ID

Magnetic field strength measurement cannot be used without entering the "Probe ID" attached to the optional magnetic field probe, PR 26M. Once you have entered it, you don't need to enter it again.

When you press **MEAS** and [ ] in that order, "Input PROBE ID" will appear in the measured

value display area on the screen. Then, input the 14-digit “Probe ID” with the numeric keypads.

Press [ ] (ENTER) to confirm it. Press [ ] (CLEAR) to delete the entire value and allow you to input one from the beginning. Press [ ] (BACK SPACE) to delete the last input figure.

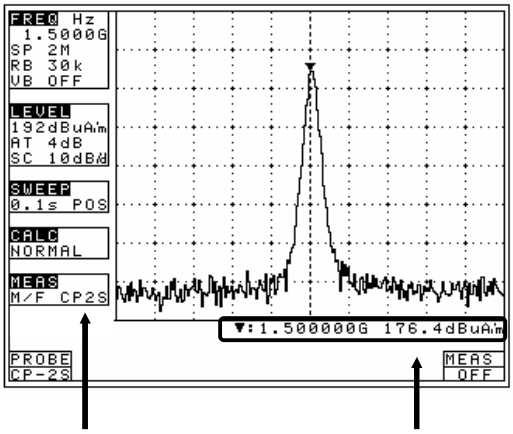
Press [ ] to cancel the probe ID input display.

? Mode selection and measurement

Use [ ] (PROBE) to select a probe, PR 26M or USER. As soon as the probe is entered, the measurement is taken.

- ? It is each shown on MEAS area of LCD as “M/F CP2S” or “M/F USER”.
- ? “USER” is an original calibration table the user creates.

(Refer to “23.1 Command description” for details.)



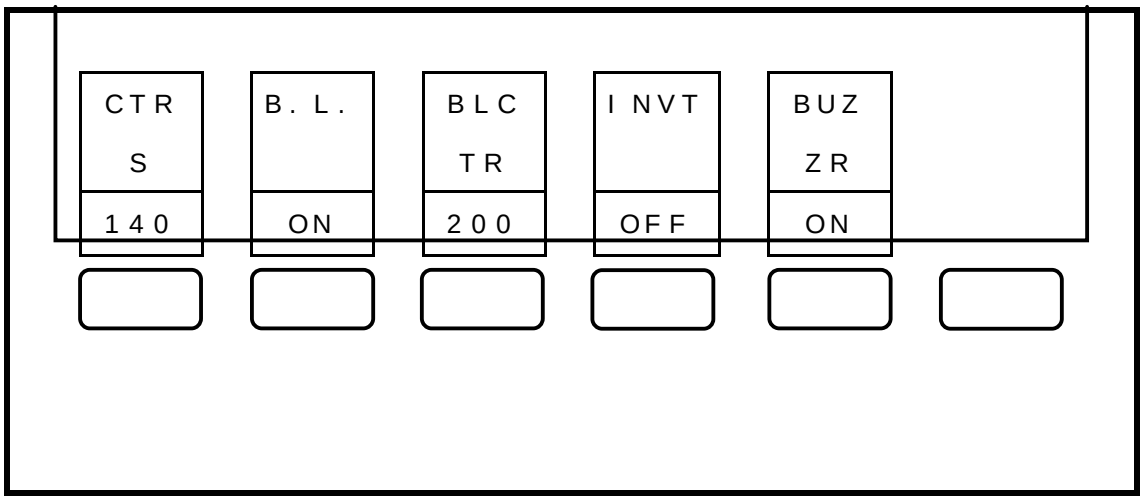
[Measuring mode] [Measured value]

Unit of amplitude axis are changing to [dBμA/m]

- ? A trace is not displayed for frequencies outside those supported by the probe.

20. Screen Control <DSPL>

Press [ ] to switch over to the function screen shown below:



20. 1 Adjusting the contrast

Use [ ] → ◯ to Adjust the contrast.

20. 2 Switching ON and OFF the LCD backlight

Each time [ ] is pressed, the LCD backlight is alternately switched to ON or OFF.

20. 3 Adjusting the brightness of the LCD backlight

Use [ ] → ◯ to set the brightness.

20. 4 Inverting the display

Press [ ] to invert the screen display. Press [ ] again to return it to the previous state.

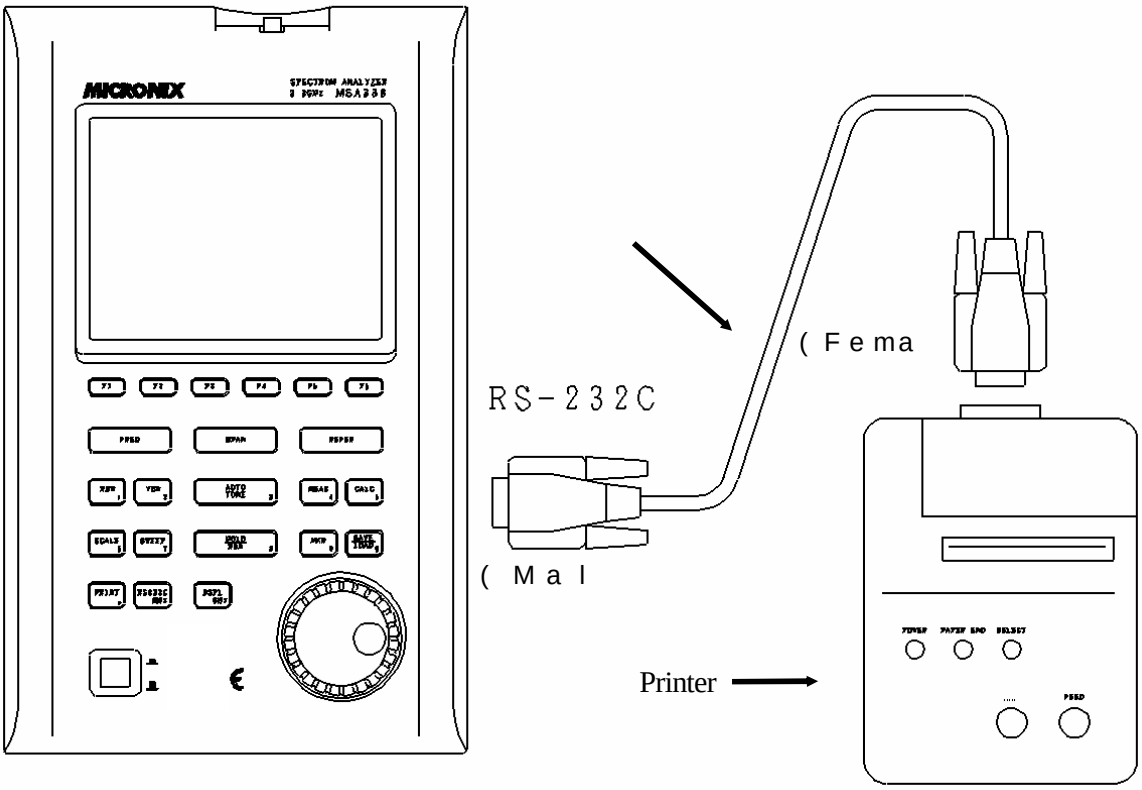
20.5 Enabling or disabling the beep

Pressing [ ] allows you to disable the beep that sounds when you operate a key or the encoder.
Press [ ] again to return it to the previous state.

21. Printing <PRINT>

21.1 How to connect

When using the optional printer, connect the RS-232C cable as shown in the figure below.



21.2 Hard copy of the screen

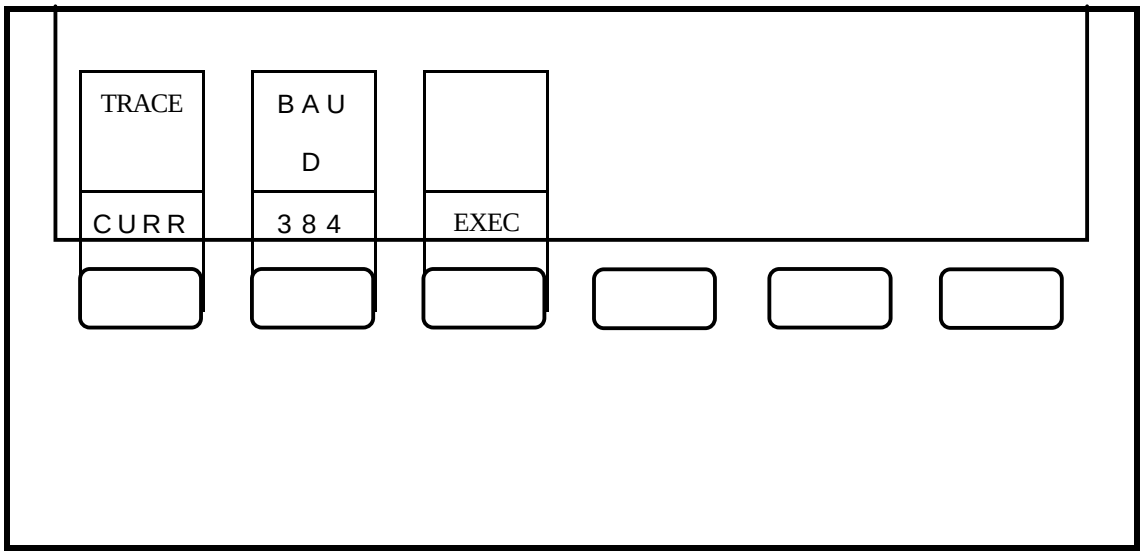
When you press the [ ] with the printer (optional) connected to the unit, it is set to the HOLD

state and starts printing. It remains in the HOLD state after the printing is finished. It stops printing if you press the [ ] again during printing.

Since the printer operates with power supply from either the AC adapter or dry batteries, you can easily produce a hard copy of measured data even when outdoors where no AC power supply is available. When battery-powered, the printer operates for approximately 30 minutes (continuous use), allowing you to produce about 80 hard copies of the screen image.

22. Data Output <RS232C>

Press [ ] to switch over to the function screen shown below:



? Refer to "23. RS-232C" for "How to connect" and "RS-232C specifications"

22.1 Selecting the trace to transfer

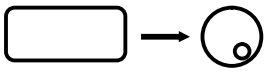
[ ]

Use → ○ to select a trace.

CURR ↔ ~~00~~ ↔ 01 ↔ ~~02~~ ↔ 03 ↔ · · · 98 99

? An asterisk (*) appears when there is a saved trace at the selected number as well as "SAVE/LOAD".

22．2 Selecting the communication speed (baud rate)

Use  to select a baud rate.

2400 ⟷ 4800 ⟷ 9600 ⟷ 19200 38400

22．3 Transfer the data

Press  to start the transfer.

The data are transmitted as ASCII cord character strings.

? Contents of data

Character strings	Description	Example
PARAM	This means that the data from the next line are “setting parameters”.	PARAM
CF **	Center frequency Refer to ?	CF 2.5140G
SP **	Frequency span Refer to ?	SP 20M
RF **	Reference level Refer to ?	RF 10dBm
ST ** ??	Sweep time and detection mode Refer to ?	ST 30ms SMP
RB **	Resolution bandwidth Refer to ?	RB 300k
VB **	Video bandwidth Refer to ?	VB OFF
SC **	Display scale (** = 10dB/d/ 2dB/d)	SC 10dB/d
TRACE	This means that the data from the next line are “trace data”.	TRACE
,,...	These are trace data. Ten two-digit hexadecimal characters separated by commas make a line, and there are 26 lines (251data) of data in total. For Trace 1001 data transfer, there are 101 lines (1001 data) of data in total.	24, 20, 1f, 1f, 1e,... ... 23

? “CR(0D[HEX]) +LF(0A[HEX]) ” is added to the tail of every data.

?: Center frequency

CF ** [** =0.0M/ 0.1M~999.9M(0.1step)/ 0.0001G~3.3G(0.0

001step)]

?:Frequency span
SP ** [**=ZERO/200k/500k/1M/2M/5M/10M/20M/
50M/100M/200M/500M/1G/2G/FULL]

?:Refernce level
RF ** [**=-40~10dBm/67~117dBμV/7~57dBmV/-53~-3dBV
/
96~154dBμV/m/109~178dBμA/m(all 1step)]

?:Sweep time and Detection mode
ST ** ?? [**=10ms/30ms/0.1s/0.3s/1s/3s/10s/30s]
[??=POG/NEG/SMP]

?Resolution bandwidth
RB ** [**=3k/10k/30k/100k/300k/1M/3M]

?Video bandwidth
VB ** [**=100/300/1k/3k/10k/30k/100k/300k/OFF]

23. RS-232C Interface

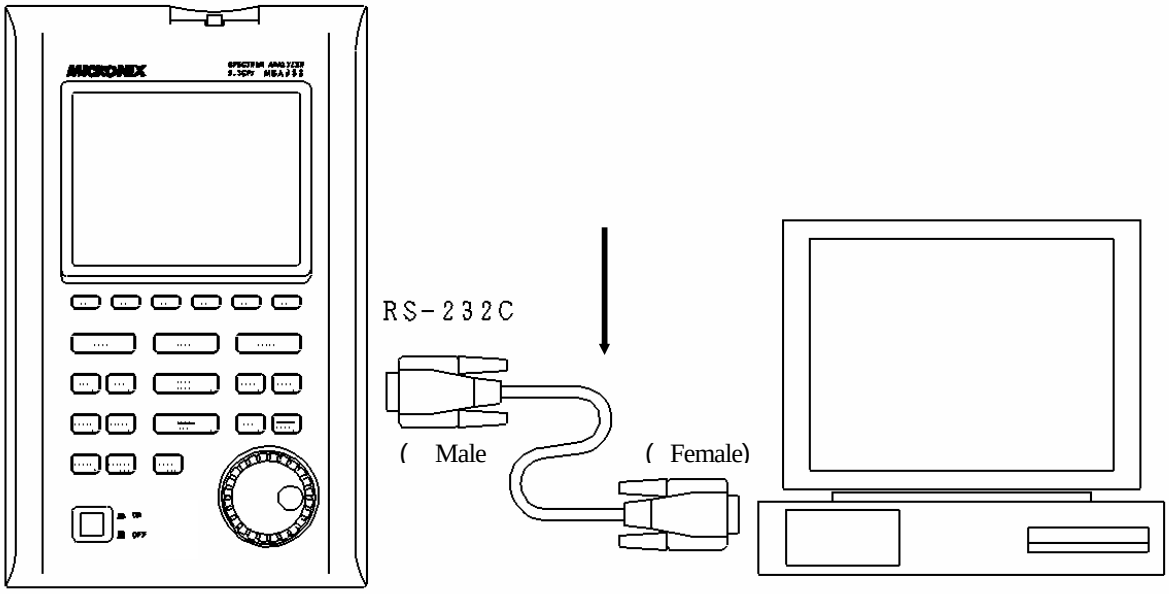
23.1 RS-232C specifications

- Transfer rate: 2400/4800/9600/19200/38400bps
- Date bit length : 8bit
- Stop bit : 1bit
- Parity check : none

23.2 How to connect

When using the RS-232C interface, connect the RS-232C cable as shown in the figure below.

? Refer to “22. Data Output” about changing baud rate.



COM PORT (Dsub 9pin, male)

? Use the conversion connector, in the case that is Dsub 25pin(male)

23.3 Command description

? “CR(0D[HEX])+ LF(0A[HEX])” is added to the tail of every command. When you send a command from your PC, MSA338 returns a response. Responses 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 returned. Except for “· · · Request” command and command for inputting corrected data.

1) Set the center frequency

Command: FREQ* * * * * * *

(* * * * * * * = Refer to ?23.4 Input the frequency?)

2) Request the set marker

Command: FREQSETMKR The center frequency is set according to the frequency of current marker position.

3) Set the span

Command: SPAN* * * *

(* * * * = ZERO/ 200K/ 500K/ 1M/ 2M/ 5M/ 10M/ 20M/ 50M/ 100M/

500M/ 1G/ 2G/ FULL[unit: Hz])

4) Set the reference level

Command: REF***

(*** = -40~10[1step, unit: dBm])

? For units other than dBm, use the conversion formulas in "9.3 Reference level setting range for each unit" to convert them into dBm before inputting the value.

5) Set the reference unit

Command: UNIT***

(*** = DBM/ DBVU/ DBMV/ DBV)

Command	Unit
DBM	dBm
DBUV	dBμV
DBMV	dBmV
DBV	dBV

6) Set the RBW

Command: RBW****

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

7) Set the VBW

Command: VBW****

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

8) Start/Stop the measuring function

Command: MEAS***

(**** = CP/ ACP/ OBW/ EF/ MF/ OFF)

Command	Measuring function
CP	Channel power measurement
ACP	Adjacent channel leakage power measurement
OBW	Occupied frequency bandwidth measurement
EF	Electric field strength measurement
MF	Magnetic field strength measurement
OFF	OFF

9) Request the result of measuring function

Command: MEASRES

? Example of the return data

Case of channel power measurement· · · POW: -25.5dBm

Case of adjacent channel power measurement· · · L: -44.7dBc U: -48.3dBc

Case of occupied bandwidth measurement· · · C: 1.45G W: 20.00k

10) Set the mode of channel power measurement

Command: CPMODE*****

(***** = TOTAL/ BAND)

Command	Mode
TOTAL	Measure the power of whole range on the screen
BAND	Measure the power within zone set

11) Set the zone center frequency of channel power measurement

Command: CPCNTR*******

(******* = Refer to ?23.4 Input the frequency?)

12) Set the zone width of channel power measurement

Command: CPWIDTH*******

(*******=Refer to ?23.4 Input the frequency?)

13) Set the mode of adjacent channel power mesurement

Command: ACPMODE*****

(*****=TOTAL/REF/PEAK)

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

14) Set the band offset of adjacent channel power mesurement

Command: ACPOFS***

(*******=Refer to ?23.4 Input the frequency?)

15) Set the bandwidth of adjacent channel power mesurement

Command: ACPCHBW****

(*******=Refer to ?23.4 Input the frequency?)

16) Set the reference band center frequency of adjacent channel power mesurement

Command: ACPREF****

(*******=Refer to ?23.4 Input the frequency?)

17) Set the reference bandwidth of adjacent channel power measurement

Command: ACPREFBW****

(*******=Refer to ?23.4 Input the frequency?)

18) Set the mode of occupied bandwidth measurement

Command: OBWMODE**

(**=N%/DB)

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

19) Set the N% ratio of occupied bandwidth mesurement

Command: OBWRATIO***

(***=80.0~99.9[0.1step?unit:%])

２０） Set the XdB down of occupied bandwidth mesurement

Command: OBWDB***

(***=0.1~40.0[0.1step?unit:dB])

２１） Set the antenna of electric field strength measurement

Command: EFANT****

(****=M301/ M302/ M303/
M304/ USER)

Command	Antenna
M301	Setting date for AN 301
M302	Setting date for AN 302
M303	Setting date for AN 303
M304	Setting date for AN 304
USER	Setting date for user's original antenna

２２） Transfer the user-correction data of electric field strength measurement

Command: EFUSER***

Example of the correction date: ***=2.25G: 2.08DBI,･･･2.65G: 3.5DBI

? If the correction coefficient is –0.3dBi at 2.5GHz, the correction data is "2.5G: -0.3DBI"
Set apart by ", " between date and input from lower frequency. 10data are available.

２３） Set the probe of magnetic field strength measurement

Command: MFPROBE****

(****=CP2S/ USER)

Command	Probe
CP2S	Setting data for PR 26M
USER	Setting data for user's original probe

２４） Transfer the user-correction date for magnetic field strength measurement

Command: MFUSER***

Example of the correction date: ***=10M: 86.7DB, 100M: 69.2DB,･･･3G: 40DB

? . If the correction coefficient is 86.7dB at 10MHz, the correction data is "10M: 86.7DB"
Set apart by ", " between date and input from lower frequency. 10data are available.

２５） Start/Stop Calculation

Command: CALC***

(***=OFF/ MAX/ MIN/
AVE/ OVR)

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

２６） Set the number of MAX HOLD

Command: MAXNO****

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

? Command 0 = unlimited

２７） Set the number of MIN HOLD

Command: MINNO****

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

28) Set the number of AVERAGE

Command: AVENO* * *

(* * * = 2 / 4 / 8 / 16 / 32 / 64 / 128 / 256)

29) Set the display scale of amplitude axis

Command: SCALE* *

(* * = 2 / 10)

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

30) Set the 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

31) Set the detection mode

Command: DET* * *

(* * * = POS/ NEG/ SMP)

Command	Detection mode
POS	Positive peak mode
NEG	Negative peak mode
SMP	Sample mode

32) Request the AUTOTUNE

Command: AUTO

? Returns the response after tuning.

33) Request the action

Command: HOLD/ RUN

34) Request the marker information

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

35) Set the marker mode

Command: MKR* * * * *

(* * * * * =NORM/ DELTA)

Command	Marker mode
NORM	Normal marker
DELTA	Delta marker

36) Set the marker position

Command: NORMMKR* * * * *

(* * * * * * * = Refer to ?23.4 Input the frequency?)

37) Set the peak search mode

Command: PEAK* * * *

(* * * * = NORM/ ZONE)

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

38) Request the peak search

Command: PKSEARCH* *

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

Command	Position to where the marker moves
01	Position of the maximum peak on the screen
02	Position of the 2nd highest peak on the screen
. . .	. . .
11	Position of the 11th highest peak on the screen

39) Set the zone center frequency of peak search

Command: PKCNTR* * * * *

(* * * * * * * = Refer to ?23.4 Input the frequency?)

40) Set the zone width of peak search

Command: PKWIDTH* * * * *

(* * * * * * * = Refer to ?23.4 Input the frequency?)

41) Set the unit of marker

Command: CONV* * *

(* * * = DBM/ W/ DBV/ V/ DBVUM/ VM)

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

42) Request the transfer of hard copy

Command: PRT ? When transferring the returned data to optional printer, hard copy is performed.

43) Request to transfer trace

Command: SRS* * * *

(* * * * = CURR/ 00 ~ 99)

Command	Trace that is transferred
CURR	Trace of Current
00	Trace of save data 1
. . .	. . .
99	Trace of save data 100

44) Request to transfer 1001 date of trace

Command: SRSF (Refer to "22.3 Transfer the data" about returned data.)

45) Request the preset

Command: PRESET

46) Set the remote control

Command: REMOTE***

(*** = ON/ OFF)

? When remote control is ON, "REMOTE" is displayed in the operating information display area on the LCD screen.

(Refer to "4. Description Of Screen" for details)

Command	Remote control
ON	Any operation from the keys or the encoder of the main body will not be accepted. Control the unit with RS-232C commands.
OFF	The operation from the keys or the encoder of the main body and RS-232C commands will be accepted.

47) Confirmation of capturing situation

Command: CAPT

? If the capturing is finished and the data can be transferred, "COMP" is returned. If the capturing is in progress and the data cannot be transferred, or if the data has not been updated, "BUSY" is returned.

23.4 Input the frequency

For the items written (******* = Refer to ?23.4 Input the frequency?) in ?23.3 Command description? above, enter a frequency as follows.

******* = 0.0k~999.9k[0.1step?unit: Hz]
0.0M~999.9M[0.1step?unit: Hz]
0.0001G~3.3G[0.0001step?unit: Hz]

? However, the offset frequency and zone width can be input only in the range decided by the center frequency and frequency span. The value out of the range becomes error.

? Values of the offset frequency and the zone width will change as you alter the frequency span.

23.5 Sample program

An example program to send following setting with RS-232C is shown below:

Setting : Center frequency 1GHz

```
10 '                                    'FREQ SETTING
20   OPEN "COM1:N81N" AS #1
30   PRINT #1 "FREQ1G                   'FREQ1G" OUTPUT
40   INPUT #1 A$                        'OK" READ
50   CLOSE #1
```

24. PC Software Model AK 2650 (optional)

Corresponding OS

Windows 95

Windows 98

Windows 2000

Windows Me

Windows NT

Installation procedure

- Start windows.
- Insert the AK 2650 software CD into the CD-ROM drive.

  The setup will start automatically and the initial screen will appear.
- Follow the instructions on the screen.

- If the setup does not start,
  - Double-click on the My Computer icon.
  - Double-click on the CD-ROM icon.
  - Double-click on “setup.exe”.
  - Follow the instructions on the screen.

Refer to the “REEDME” in the 2650 for details.

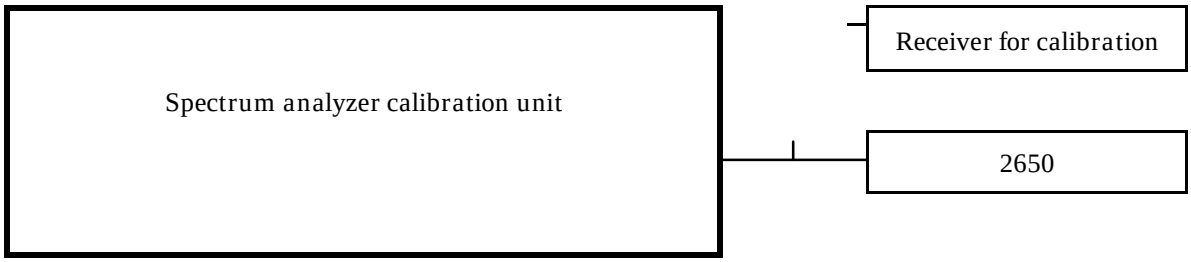
- The software can be updated from our Web site.

  See our Web site or the “REEDME” in AK 2650 for details.
- URL: http: //www.bkprecision.com

25. Basis Performance Test

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 dealership where you purchased the product, or contact us.

[Connection diagram]



25.1 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 MSA338			Specifications	Measurement value	Judgment
Center frequency	Frequency span	RBW			
50kHz	200kHz	10kHz	within Reference±2.6dB±1 dot		
100kHz	200kHz	30kHz	within Reference±2.6dB±1 dot		
1MHz	2MHz	100k	within Reference±1.6dB±1 dot		

		Hz			
10MHz	10MHz	3MHz	within Reference±1.0dB±1 dot		
100MHz	10MHz	3MHz	Reference		
1GHz	10MHz	3MHz	within Reference±1.0dB±1 dot		
2GHz	10MHz	3MHz	within Reference±1.0dB±1 dot		
3.3GHz	10MHz	3MHz	within Reference±1.0dB±1 dot		

? RBW switching error is included at RBW other than 3MHz.

?Setting of 2650

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

?Setting of calibration unit

Frequency : Same as a center frequency of 2650. However, no outputs for 0 Hz
Output power : Adjust the power indication of 2650 to -15dBm.

25.2 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 2650 Reference level	Specifications	Measurement value	Judgment
+10dBm	within ±1.4dB±1 dot		
0dBm	within ±1.4dB±1 dot		

-10dBm	within ±1.4dB ±1 dot		
-15dBm	within ±0.8dB ±1 dot		
-20dBm	within ±1.4dB ±1 dot		
-30dBm	within ±1.4dB ±1 dot		
-40dBm	within ±1.4dB ±1 dot		

? Input attenuator switching error is included at the reference level other than –15dBm.

?Setting of 2650

Center frequency : 100MHz
Frequency span : 10MHz
RBW : 3MHz
VBW : OFF
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 2650 is at the 0th div from the top.

25.3 The display accuracy of the center frequency

Measure the frequency with the peak search function of 2650.

Setting of 2650			Specifications	Measurement value	Judgment
Center frequency	Frequency span	RBW			
100MHz	200kHz	3kHz	within ±130kHz ±1 dot		
100MHz	10MHz	30kH	within ±130kHz ±1		

		z	dot		
100MHz	20MHz	100kHz	within ±800kHz ±1 dot		
100MHz	200MHz	100kHz	within ±800kHz ±1 dot		
1GHz	500MHz	100kHz	within ±800kHz ±1 dot		
1GHz	2GHz	3MHz	within ±800kHz ±1 dot		
1.65Hz	FULL(3.3GHz)	3MHz	within ±800kHz ±1 dot		

?Setting of 2650

Reference level : -15dBm

VBW : AUTO

Sweep time : 1s

Detection mode : SMPL

Display scale : 10dB/div

?Setting of calibration unit

Output power : -15dBm

? However, calibrate the signal generator in advance.

25.4 The display accuracy of the 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 accuracy of the frequency span indication.

Setting of 2650			Specifications	f_1 Measurement value	f_9 Measurement value	$(f_9 - f_1) \times 1.25$	Judgment
Frequency span	Center Frequency	RBW					
200kH	100M	3kHz	within ±26kHz				

z	Hz		±1 dot				
10MHz	100MHz	100kHz	within ±320kHz ±1 dot				
20MHz	100MHz	300kHz	within ±0.8MHz ±1 dot				
200MHz	100MHz	3MHz	within ±6.2MHz ±1 dot				
500MHz	1GHz	3MHz	within ±15.2MHz ±1 dot				
2GHz	1GHz	3MHz	within ±60.2MHz ±1 dot				
FULL (3.3GHz)	1.65GHz	3MHz	within ±99.2MHz ±1 dot				

? f_1: 1st div from the left on the trace screen f_9: 9th div from the left on the trace screen

?Setting of 2650

Reference level : -15dBm
VBW : AUTO
Sweep time : 1s
Detection mode : SMPL

?Setting of calibration unit

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

25.5 Linearity of the 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 2650.

Setting of 2650 Display scales	Output of calibration unit	Specifications	Measurement value	Judgment
10dB/div	X dBm (adjust it to the 0th div)	Reference(-15dBm)	(-15dBm)	
	X -10dB	within -25dBm±0.8dB±1 dot		
	X -70dB	within -85dBm±1.6dB±1 dot		
2dB/div	X dBm (adjust it to the 0th div)	Reference(-15dBm)	(-15dBm)	
	X -2dB	within -17dBm±0.2dB±1 dot		
	X -10dB	within -25dBm±0.8dB±1 dot		

?Setting of 2650

Center frequency : 100MHz
Reference level : -15dBm
Frequency span : 10MHZ
RBW : 3MHz
VBW : OFF
Sweep time : 1s
Detection mode SMPL

?Setting of calibration unit

Frequency : 100MHz