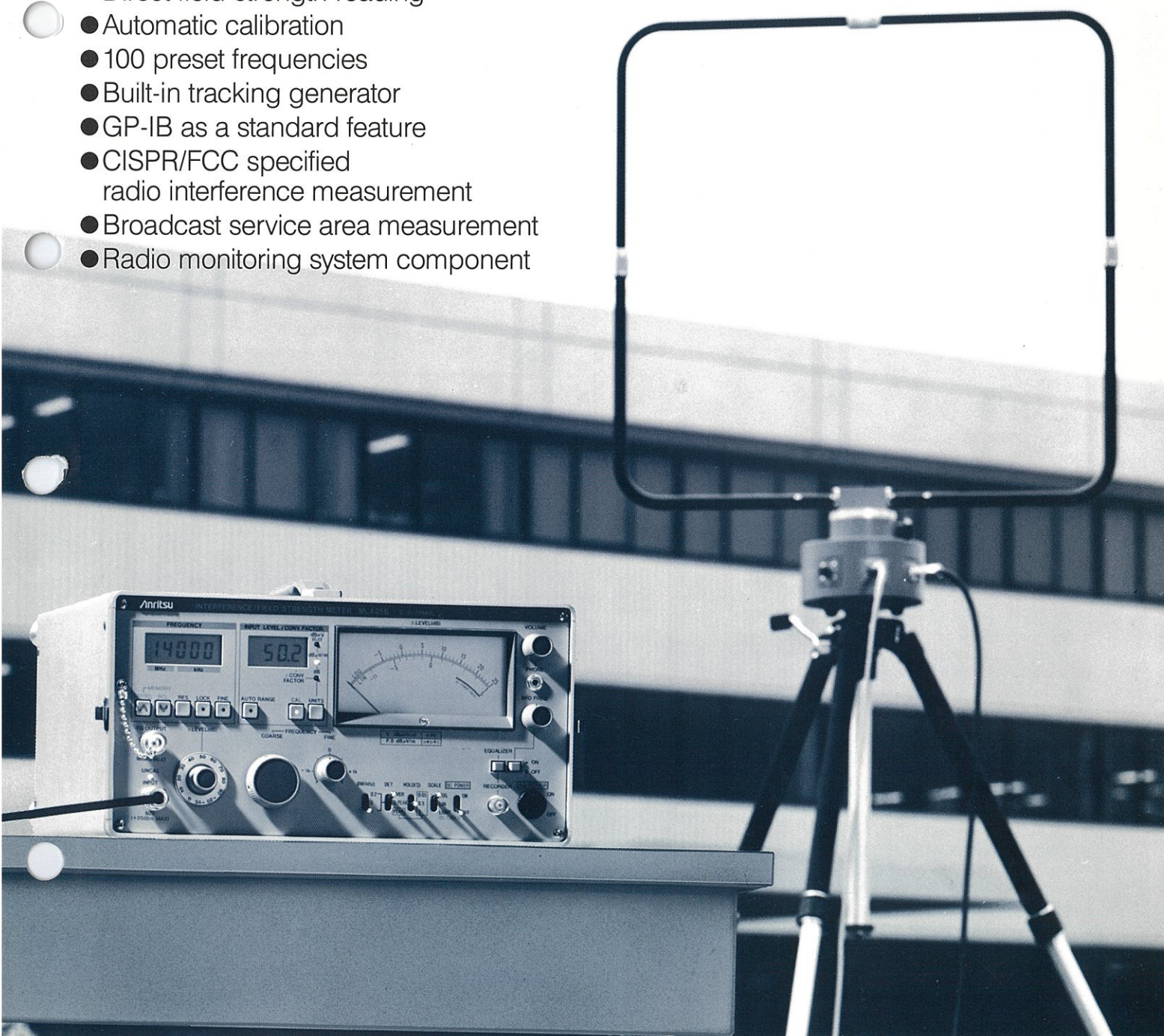


Interference/Field Strength Meter

ML428B

9kHz to 30MHz

- Synthesizer local oscillator
- Direct field-strength reading
- Automatic calibration
- 100 preset frequencies
- Built-in tracking generator
- GP-IB as a standard feature
- CISPR/FCC specified radio interference measurement
- Broadcast service area measurement
- Radio monitoring system component



Specifications

Input impedance			50Ω nominal (BNC connector)	
Frequency	Frequency range		9kHz to 30MHz	
	Display		5 digits LCD, lowest 1kHz, 10kHz to 30MHz	
	Frequency settings		Step dial: 1kHz, 10kHz, 100kHz, 1MHz, selectable Fine dial: ±1kHz, continuously variable	
	Memory		100 frequencies	
	Reference oscillator	Aging rate	±1×10 ⁻⁶	
Temperature stability		±2.5×10 ⁻⁵		
Level	Voltage (Terminated value)	Minimum value	9kHz to 49kHz	-15dBμV (at C/N=6dB, bandwidth 200Hz, average value)
			50kHz to 149kHz	-17dBμV (at C/N=6dB, bandwidth 200Hz, average value)
			150kHz to 30MHz	-20dBμV (at C/N=6dB, bandwidth 200Hz, average value)
		Maximum value	LOG (Meter display)	115dBμV
			LIN (Meter display)	95dBμV
			Digital display	115dBμV
	Accuracy		±1.5dB (at ≥ minimum value +20dB)	
	Field strength	Minimum value	20kHz	41dBμV/m (at C/N=6dB, bandwidth 200Hz, average value)
			500kHz	29dBμV/m (at C/N=6dB, bandwidth 200Hz, average value)
			30MHz	16dBμV/m (at C/N=6dB, bandwidth 200Hz, average value)
		Maximum value	10kHz to 2.5MHz	140dBμV/m (in LOG scale or digital display)
			2.5MHz to 30MHz	130dBμV/m (in LOG scale or digital display)
		Accuracy*		±2dB (at ≥ minimum value +20dB)
	Type of antenna		MP414B Loop Antenna	
	Calibration oscillator		Sine wave, automatically set to receiving frequency	
	Meter scale		10dB full scale, 1dB resolution (in LIN mode) 30dB full scale, 1dB resolution (in LOG mode)	
	Digital display	Display	4 digits LCD, lowest 0.1dB	
		Unit	dBμV, dBμV/m, dB (for antenna conversion factor)	
	Input level adjustment		Manual and auto ranging Adjustable range: 110dB (10dB step RF attenuator, 10dB×6)	
Selectivity	6dB bandwidth	200Hz band	200± ²⁰ ₃₀ Hz	
		3kHz band	3kHz ±0.3kHz	
		9kHz band	9kHz ±1kHz	
	Rejection	200Hz band	≥50dB (1kHz off center)	
		3kHz band	≥50dB (2.5kHz off center)	
		9kHz band	≥50dB (13.5kHz off center)	
	Signal to image ratio		≥70dB	
Detection time constant	Average value		Charge-time constant ≤20μs, Discharge-time constant ≤20μs	
	Quasi-peak value	Charge-time constant 45ms ±20% Discharge-time constant 500ms ±20% } (9kHz to 150kHz) Charge-time constant 1ms ±20% Discharge-time constant 160ms ±20% } (150kHz to 30MHz)		
		Peak value	Charge-time constant ≤20μs Holding time: 0.05, 0.3, 3s switch selectable	
Overload factor			Before detection: 24dB (9kHz to 150kHz), 30dB (150kHz to 30MHz) After detection: 6dB (10kHz to 150kHz), 12dB (150kHz to 30MHz)	
Pulse response			Conforms to CISPR specifications (at linear scale meter indication)	
Output	IF output	Frequency	455kHz	
		Level	≥86dBμV (50Ω load with indicator at 0dB)	
		Impedance	50Ω (BNC connector)	
	Output for recorder	Level	1V ±10% (100kΩ load with indicator at full scale)	
		Impedance	≤150Ω (BNC connector)	
Monitor output		A1A, A2B, A3E wave can be monitored with internal speaker or earphone. BFO is provided.		
Tracking generator		Frequency setting	Automatically set to receiving frequency	
		Output	95dBμV ±1dB (Terminated value), sine wave	
		Impedance	50Ω (BNC connector)	
Remote control			Compatible with IEEE-488 (GP-IB) Interface function: SH1, AH1, T7, TE0, L4, LE0, SR1, RL2, PP0, DC1, DT0, C0	
Ambient temperature, rated range of use			0° to 50°C	
Power			AC **V, 50/60Hz, ≤40VA, DC 11.5 to 24V, ≤2A	
Dimensions and weight			145H×280W×350Dmm, <11kg	

* Using the calibration table. Accuracy of direct reading is ± 3 dB.

** Specify one nominal line voltage between 100 V and 250 V when ordering.

TH MET

TOR
(B μ V
(C))

B μ V/m

dB

UNITS

CY

FINE

0

R

Despite its compact size and light weight, the ML428B covers a wide frequency range of 9kHz to 30MHz. Not only does it enable measurement of the field strength of general broadcasts and radio communications, but it can also measure interference waves in accordance with CISPR, VDE or FCC or other, specifications. The ML428B has a local synthesizer and high-precision sine-wave comparison oscillator to obtain data with excellent repeatability. In addition, the built-in microprocessor allows level calibrations and attenuator operation to be automatically performed to enable direct reading of the field strength and efficient measurement. The ML428B has a GP-IB interface as standard, and can be used to form a low-cost computer-controlled system.

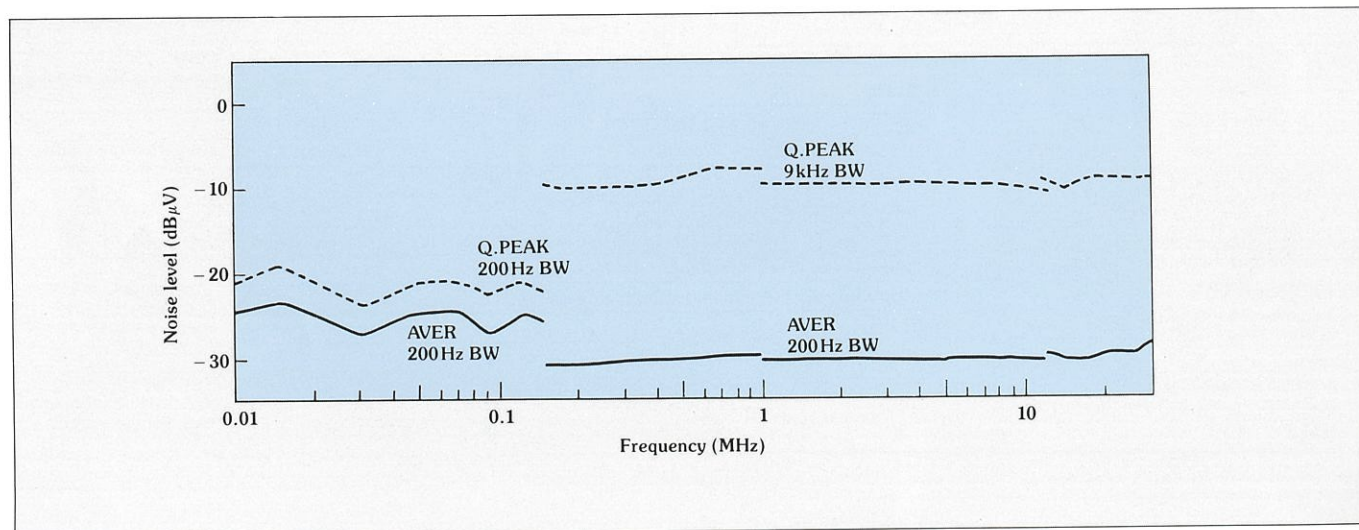
Applications

- Measurement of radiated and conducted interference from digital devices, ISM devices, household appliances, etc.
- Measurement of noise in urban areas
- Measurement of broadcasting stations service area, effective radiated power and spurious emission
- Measurement of radio waves transmitted from radio wave applied devices (small powered wireless stations, small power facilities)
- Measurement of radio wave propagation characteristics
- Measurement of various antenna characteristics
- Measurement of shield effectiveness
- Measurement of oscillator levels
- Measurement of transmission characteristics of electronic circuits
- Investigating radio interference, monitoring and direction finding

Features

- Interference measured in accordance with CISPR specifications
- Wide 9kHz to 30MHz bandwidth
- High frequency stability from use of frequency synthesizer in local oscillator
- Compact and lightweight
- Direct field strength reading
- Up to 100 frequencies stored
- Built-in tracking generator optimized for antenna characteristics measurement and blocking effectiveness of shield materials
- Prompt measurement through use of auto-range function
- GP-IB interface for computer-controlled system
- Direct field strength readout for conventional antenna by memorizing coefficient via GP-IB
- Convenient outdoor operation through use of DC power source

ML428B Characteristics



FINE ADJUSTMENT KEY (with lamp)
Pressing this key enables operation of the frequency fine adjustment dial.

FREQUENCY LOCK KEY (with lamp)
Pressing this key fixes the frequency and prevents other frequencies from being set.

FREQUENCY STORE/RECALL KEY
Pressing this key stores the presently-displayed frequency value in the memory.
Repeated pressing of this key enables further storage of frequencies as required. A maximum of 100 frequencies can be stored.

FREQUENCY RECALL KEY
This key recalls and sets the frequencies stored in the memory.
The order for recalling is the reverse of that used for storing the frequencies. (i.e. the information stored last is recalled first, and displayed.)

FREQUENCY STEP SETTING KEY
This switch selects the steps for the frequencies set by the frequency setting dial. (i.e. the steps change in the following order, each time this key is pressed.)

- 1 MHz column
- 0.1 MHz column
- 0.01 MHz column
- 0.001 MHz column

The present step can be seen by looking at the frequency display column which contains the blinking numeral.

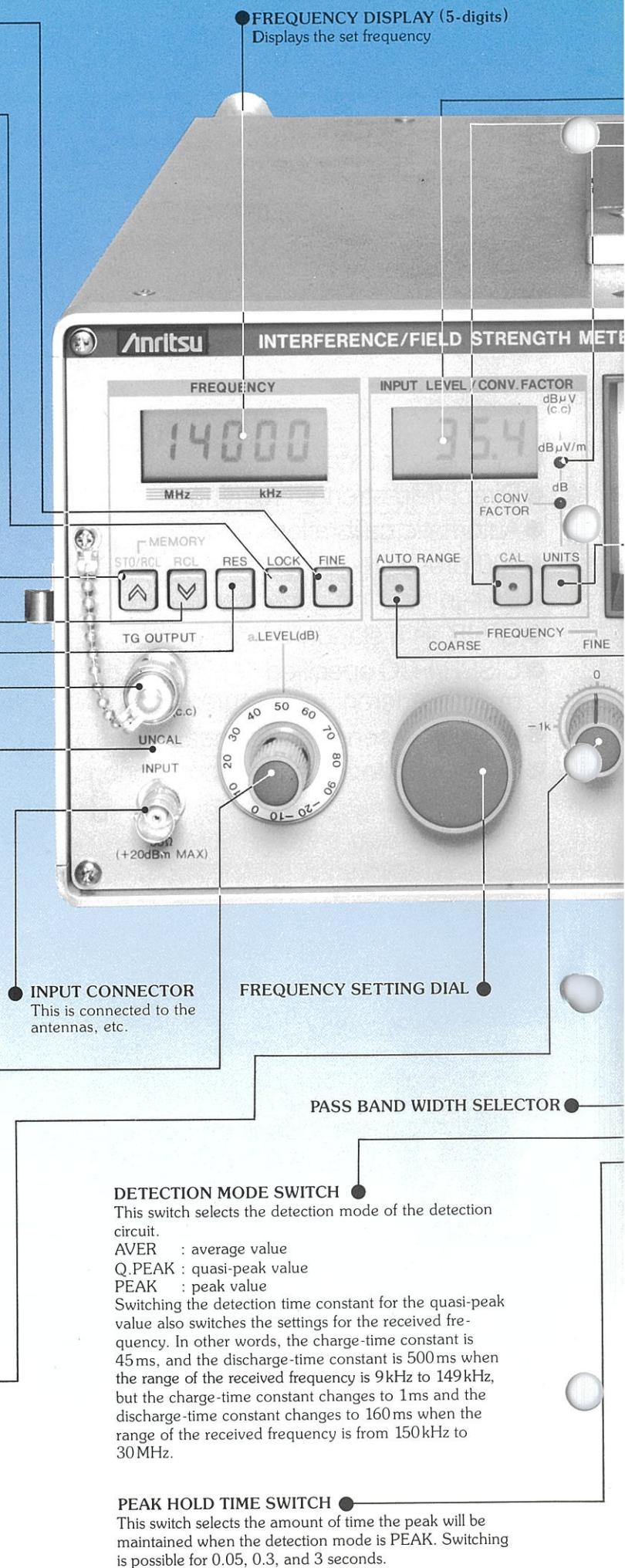
TRACKING GENERATOR OUTPUT CONNECTOR
This connector outputs signals of a frequency equivalent to the received frequency. The output level is constant at 95 dB μ V (Terminated value).

UNCAL LAMP
Even though the meter may appear to be operating normally, there is no guarantee of the measurement level if this lamp lights when the meter is being used as a receiver. Press the level correction key to perform level corrections when this lamp is lit. The lamp goes out once corrections have been performed. This lamp will also be lit when the signal receiving system is saturated due to input overload. The signal receiving system will be saturated and correct values may not be displayed when measuring the pulse noise in the Q. PEAK mode even though the indicator movement may appear normal. When this occurs, resetting the level adjustment dial will cause the lamp to go out, and measurement may proceed.

LEVEL DIAL
This dial adjusts the indicator to the proper scale. It is comprised of an RF attenuator and an IF attenuator with the combinations pre-programmed.

FREQUENCY FINE ADJUSTMENT DIAL
This dial fine-adjusts the receiving frequency. Turning this dial does not alter the frequency display. It is only operative when the fine-adjustment key has been pressed.

FREQUENCY DISPLAY (5-digits)
Displays the set frequency



DETECTION MODE SWITCH
This switch selects the detection mode of the detection circuit.

AVER : average value
Q. PEAK : quasi-peak value
PEAK : peak value

Switching the detection time constant for the quasi-peak value also switches the settings for the received frequency. In other words, the charge-time constant is 45 ms, and the discharge-time constant is 500 ms when the range of the received frequency is 9 kHz to 149 kHz, but the charge-time constant changes to 1 ms and the discharge-time constant changes to 160 ms when the range of the received frequency is from 150 kHz to 30 MHz.

PEAK HOLD TIME SWITCH
This switch selects the amount of time the peak will be maintained when the detection mode is PEAK. Switching is possible for 0.05, 0.3, and 3 seconds.

DIGITAL LEVEL DISPLAY

This displays the voltage, field strength or the conversion factors. When the voltage level is displayed, the terminated value is displayed.

LEVEL CALIBRATION KEY (with lamp)

Pressing this key will automatically perform a series of level calibration operations. The lamp lights when corrections are in progress.

UNIT DISPLAY LAMP

The corresponding lamp lights to display the units selected by the units selection key.

INDICATOR

The sum of the value indicated by the indicator, and the value set by the level dial becomes the measured value of the input level. Scale switching is possible between the linear (LIN) and logarithmic (LOG, dB linear) scales.

MONITOR VOLUME ADJUSTMENT**EARPHONE OUTPUT JACK****UNIT SELECTION KEY**

This key is used to select the units of the levels which are displayed on the digital level display. The units which can be selected are voltage: $\text{dB}\mu\text{V}$, field strength: $\text{dB}\mu\text{V}/\text{m}$, and conversion factor: dB. The results of the selection are displayed on the unit display lamp. Pressing the switch changes the display through $\text{dB}\mu\text{V}$ to $\text{dB}\mu\text{V}/\text{m}$ to dB to $\text{dB}\mu\text{V}$ in order.

BFO FREQUENCY TUNING KNOB

This knob tunes the BFO frequency from the zero beat point to approximately $\pm 5\text{ kHz}$.

AUTO-RANGE KEY (with lamp)

Setting the level dial is normally performed by the operator so that the indicator moves to the appropriate value. However pressing this key will automatically set this level dial.

BFO SWITCH

This switch operates the beat frequency oscillator. The BFO operates when this switch is ON. It is used for monitoring AIA waves.

EQUALIZER SWITCH

The indicator has mechanical time constants that conform to CISPR specifications. Therefore, it is necessary to send the signals to the data recorder through a circuit having characteristics equivalent to the mechanical time constant of the indicator, when measured values are being stored. This switch is used to turn the equalizer circuit on and off.

AC POWER SWITCH**RECORDER CONNECTOR**
For connection of an analog recorder.**DC POWER SWITCH****SWITCH FOR SCALE CHANGEOVER AND DC POWER SUPPLY VOLTAGE CHECK**

This switch changes the range of the indicator. The range is 10 dB for LIN and 30 dB for LOG. The same switch can be used to check the AC supply voltage when in the CHECK position.

ADDRESS SWITCH

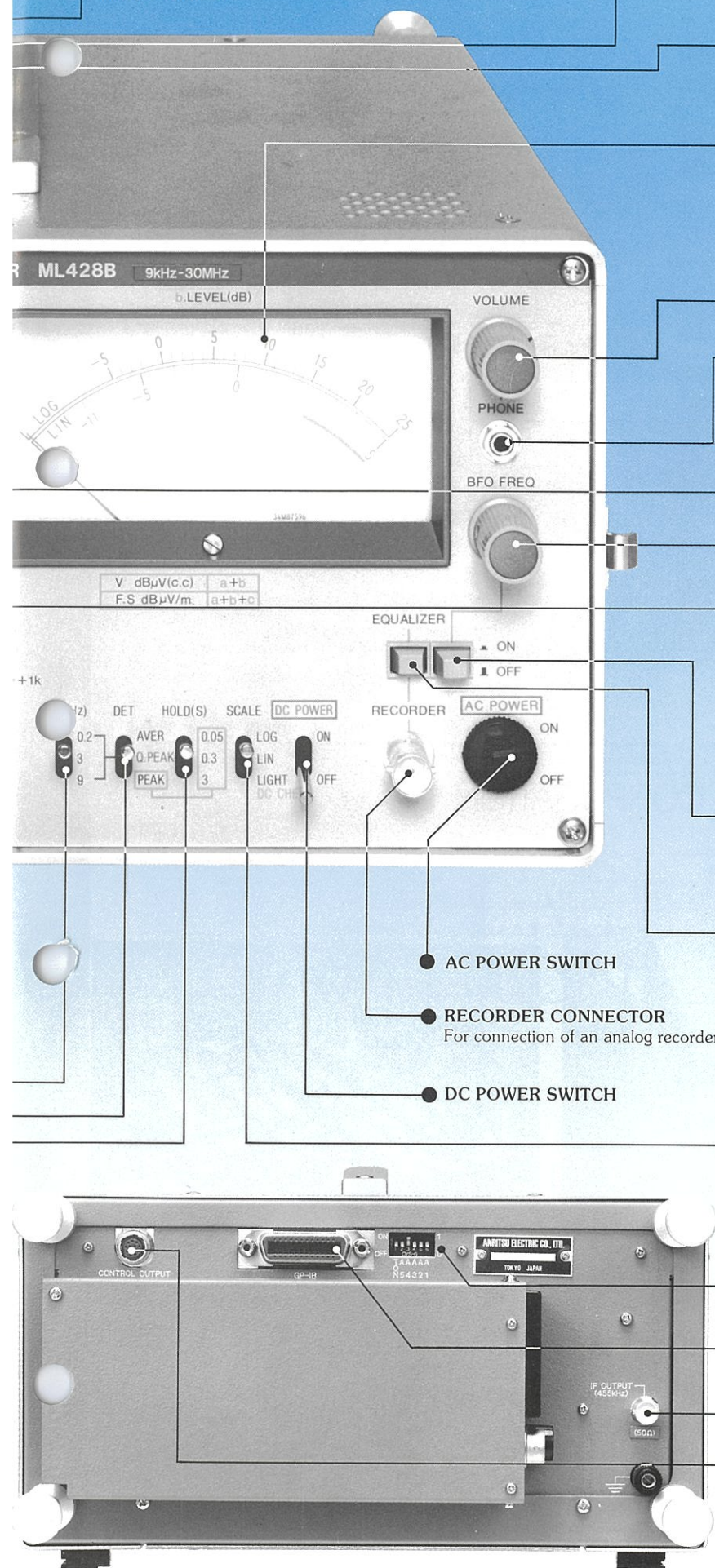
This switch sets device address.

GP-IB CONNECTOR

This connects an IEEE-488 digital standard bus to the ML428B.

IF OUTPUT CONNECTOR**CONTROL CONNECTOR**

This connector enables antenna control cords to be connected to the controller. Several matching transformers are built into the antenna. However, selection of these is performed automatically by the ML428B.



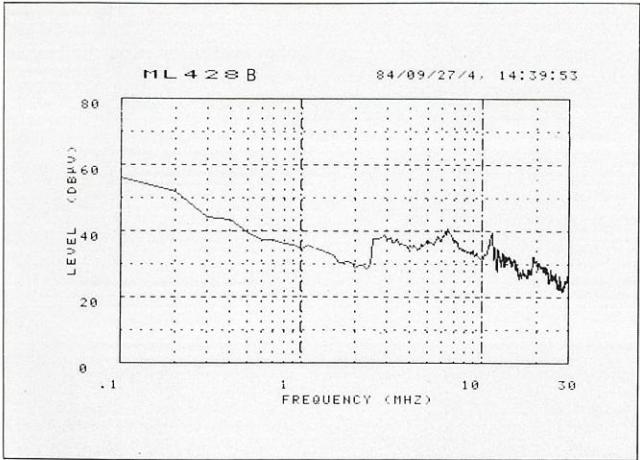


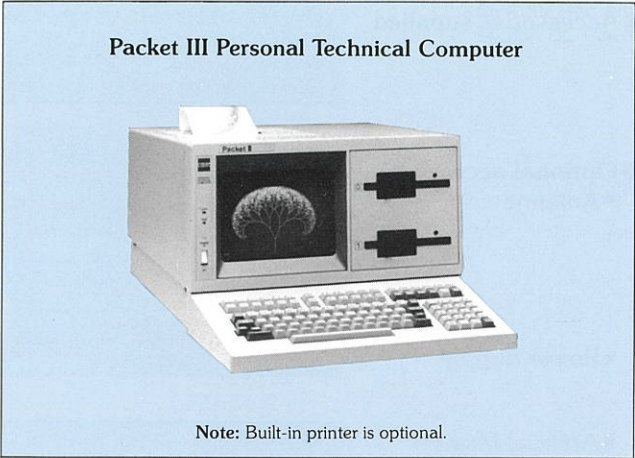
Fig. 1 Executed results of static measurement program

Code	Function	Remarks
CF	Set frequency	
CL	Execute calibration	
RL	Set reference level	
DM	Set to dBμV/m	
DV	Set to dBμV	
CT	Set to CONVERSION COEFFICIENT	
AR	Set to AUTO RANGE	
MD	Select a DETECTION MODE	MD1: AVER, MD2: Q. PEAK, MD3: PEAK
BW	Select a BW	BW1: 200 Hz, BW2: 3 kHz, BW3: 9 kHz
OF	Output the set frequency	
OL	Output the measured level	
OR	Output the reference level	
EQ0	Turn equalizer OFF	
EQ1	Turn equalizer ON	
AF	Set the conversion coefficient table	
ST	Start making the conversion coefficient table	
SP	Stop making the conversion coefficient table	

Table 1 Device function codes

940	!-----
950	!
960	SET CLIP "ON"
980	SET LINE STYLE 1
990	WRITE @108:"RL20"
991	WRITE @108:"BW3"
992	WRITE @108:"DV"
993	WRITE @108:"MD2"
995	WRITE @108:"EQ1"
1000	FOR XX=.1 TO 30 STEP .1
1020	WRITE @108 USING "C2,1F6.3": "CF",XX
1030	LET X=LOG(XX)/2.3
1040	WAIT DELAY 2
1050	WRITE @108:"OL"
1051	READ @108:A#
1060	LET Y=VAL(A#(3:8))
1080	PLOT X,Y;
1090	NEXT XX
1150	SET CLIP "OFF"
1162	CLEAR 0
1190	STOP
1200	!
1210	!-----

Table 2 Program list



The ML428B has a GP-IB interface so that its functions can be controlled by an external computer. The computer can therefore control the setting of the frequency, attenuator, detection mode and bandwidth, etc., and can also perform level calibration and read the measured voltage or field strength. Automatic measurement can be carried out easily if the program is compiled according to the measuring procedure. Table 1 lists the functions that can be externally controlled. The list in Table 2 is the part of a simple program that relates to GP-IB control, and which uses an artificial power line network to measure the noise generated in electronic devices. Measurement is performed in 100 kHz steps from 100 kHz to 30 MHz. The results of the execution of this program are shown in Fig. 1. In addition to computer control such as that provided by the GP-IB, the ML428B also has a talk-only mode for direct output of frequencies and measured levels to a printer without use of a computer.

Supplied Accessories/Optional Accessories

● Accessories supplied

One AC power cord: (2.5 m), One earphone
 One DC power cord: RM12BPG—5S•2CC7•arrow tip, 1.5 m
 One coaxial cord: 3CA-P2•RG-55/U•3CA-P2, 1 m
 One connecting cord for recorder: BNC—P•—•Alligator clip, 1.5 m

● Optional accessories

● Antenna

MP414B Loop Antenna	(9 kHz to 30 MHz), One carrying case, one connection cord for remote control, one coaxial cord
MP415B Rod Antenna	(9 kHz to 30 MHz), One carrying case, one connection cord for remote control, one coaxial cord
MB27A Tripod	

● Power Supply

MZ88A DC Power Supply	(12 V, 7.5 AH), supplied with one battery charger
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● Artificial Mains Network

MN423B Artificial Mains Network	Conforms to CISPR Publ. 1. Supplied with one 75 Ω /50 Ω pad. (Max. 15 A, for 150 kHz to 30 MHz measurement use)
MN424B Artificial Mains Network	Conforms to FCC Specification Part 15. (Max. 15 A, for 450 kHz to 30 MHz measurement use)
MN425B Artificial Mains Network	Conforms to FTZ specification. (Max. 15 A, for 10 kHz to 30 MHz measurement use)

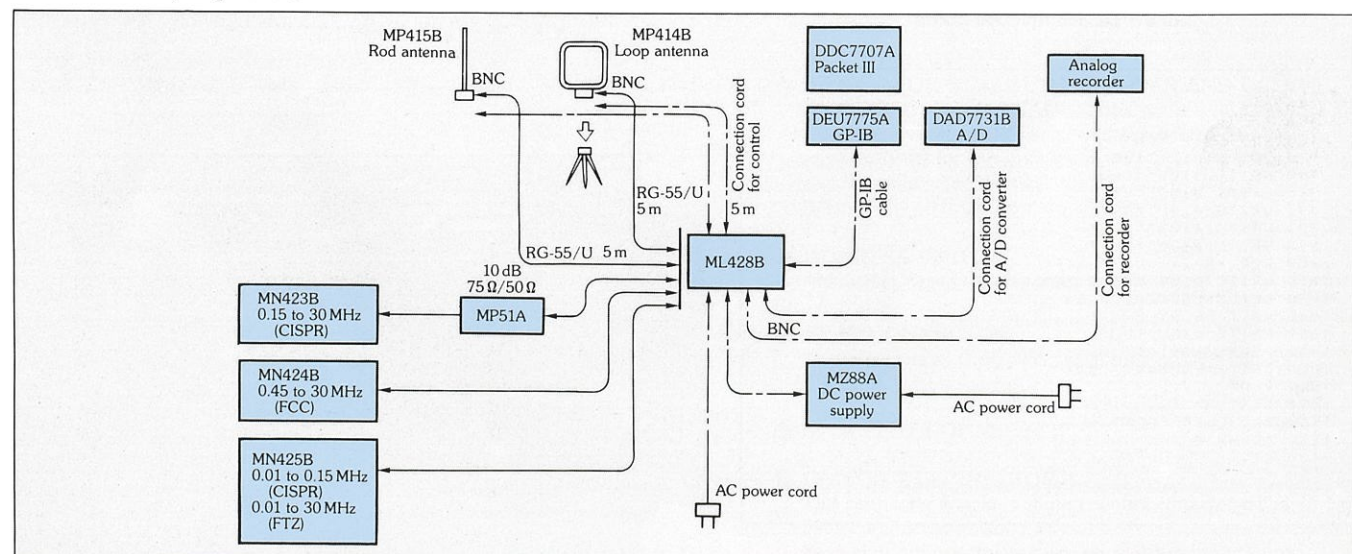
● Computer

Personal Technical Computer Packet III (OPT 02, 03)	(RAM 512 kB, two built-in floppy disk drives, GP-IB interface, built-in printer)
GP-IB Cable, 2 m	Order number: J0008

Accessory selection guide

	Antenna		Artificial mains network		
	MP414B	MP415B	MN423B	MN424B	MN425B
Interference measurement (CISPR)	●	●	●		
Interference measurement (FCC)				●	
Interference measurement (FTZ)	●	●			●
Field strength measurement	●				
Radio wave propagation measurement	●				
Field strength measurement on radio waves transmitted from small power radio station, etc.	●				

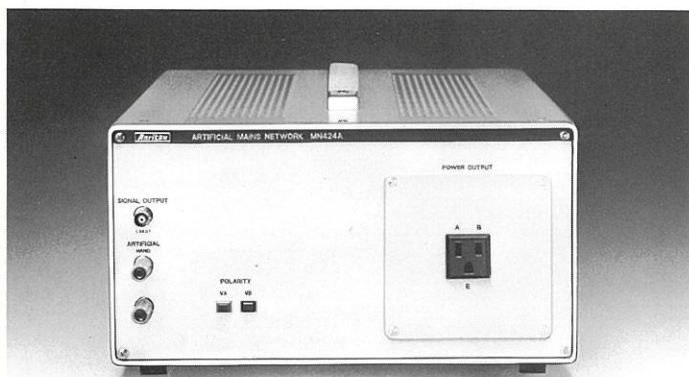
ML428B and peripherals



MP414B Loop Antenna
MB27A Tripod



MP415B Rod Antenna
MZ88A DC Power Supply



MN424B Artificial Mains
Network

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