

MF2400B Series

Microwave Frequency Counter

10 Hz to 20/27/40 GHz



The Most up to Date Comprehensive Frequency Measurement Available

Latest Burst Wave Measurement

The line up of MF2400B series is composed of three frequency counters: the MF2412B (20 GHz), the MF2413B (27 GHz), and the MF2414B (40 GHz).

They are ideal for evaluating mobile radio communications devices and circuits, and are also able to measure the carrier frequency and pulse width of burst signals.

In addition to displaying measurements results on a 12-digits LCD, the frequency values can be read using the analog display function, which can be used for monitoring

evaluation and especially for frequency adjustment, etc., of various types of oscillators.

Furthermore, the template function is useful for assessing whether or not the measurement results fall within the upper and lower frequency limit specifications; the evaluation result is output from the AUX connector on the rear panel as Go/No-go signal. An easy-to-use automatic measurement system can be configured using the GPIB function.



Wide Band Measurement

The line up of three counters upper frequency limits of 20, 27, and 40 GHz meet every type of usage requirement. In addition, a high-frequency fuse holder and fuse element protect the input circuit from excessively powerful signals, and a variety of adapters are available for coupling each connector.

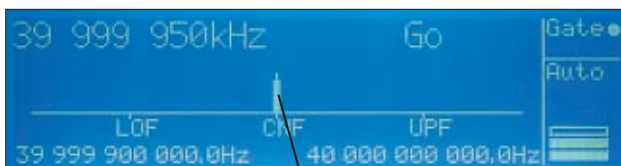
High-Accuracy Burst Measurement

The carrier frequency, burst width and burst repetition rate of a 100 ns to 0.1 s burst signal input from INPUT 1 can be measured quickly at high accuracy.

| Measurement | Positive selected | Negative selected |
|------------------|----------------------------------|-----------------------------------|
| Burst width | Measurement at Burst ON time | Measurement at Burst OFF time |
| Burst repetition | Measurement of On-On period | Measurement of Off-Off period |

Analog Display Function

Using this function, the entire LCD becomes an analog meter and the measured values are indicated by the position of the meter needle. In addition to grasping changes in the measured frequency, this permits faster frequency adjustment and Go/No-go judgement of oscillators which had to be read many digits of measured data before. This analog meter also solves problems of misreading of frequency value.



Moves left/right and indicates frequency value

Template Function

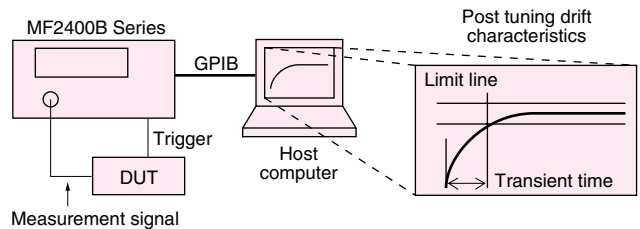
When the upper and lower frequency limits have been preset, if the measured frequency is within the preset range, Go is displayed; if it is out of range, No-go is displayed. In addition, the Go/No-go signal can be output from the AUX connector on the back panel as a TTL signal.

This is very useful for configuring an automatic device Pass/Fail evaluation system (using analog display).

High-Speed Transient Measurement

Frequency counters have an interval when measurement is not performed (sample rate), so that sudden frequency changes during this period can not be measured.

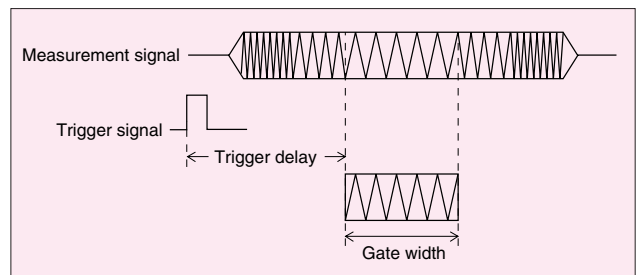
However, the MF2400B series overcomes this problem by capturing frequency changes at speeds of up to 10 μ s and saving a maximum of 2000 sampling points. When it is combined with a host computer, frequency changes can be displayed graphically. This is very effective for measuring VCO start-up characteristics and PLL lock times.



Gating Function

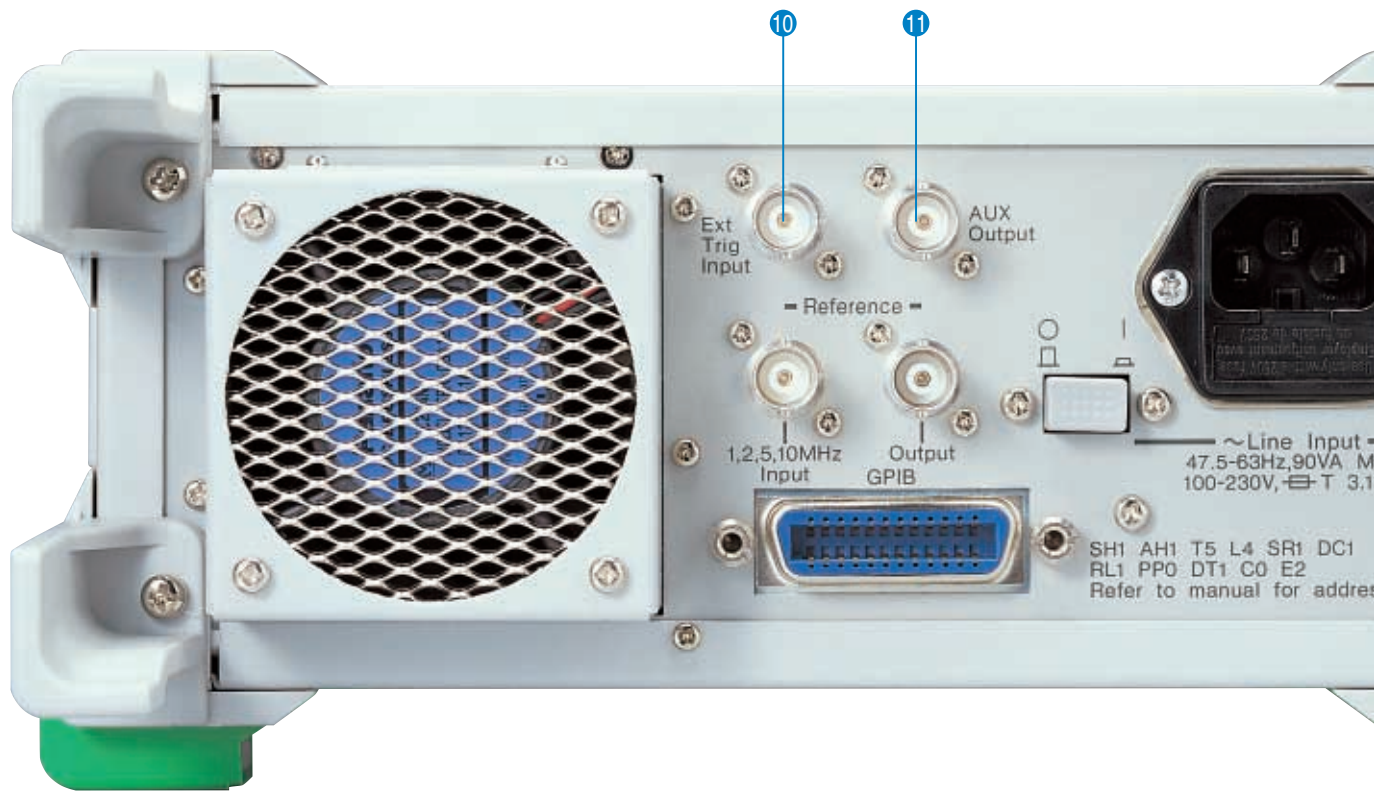
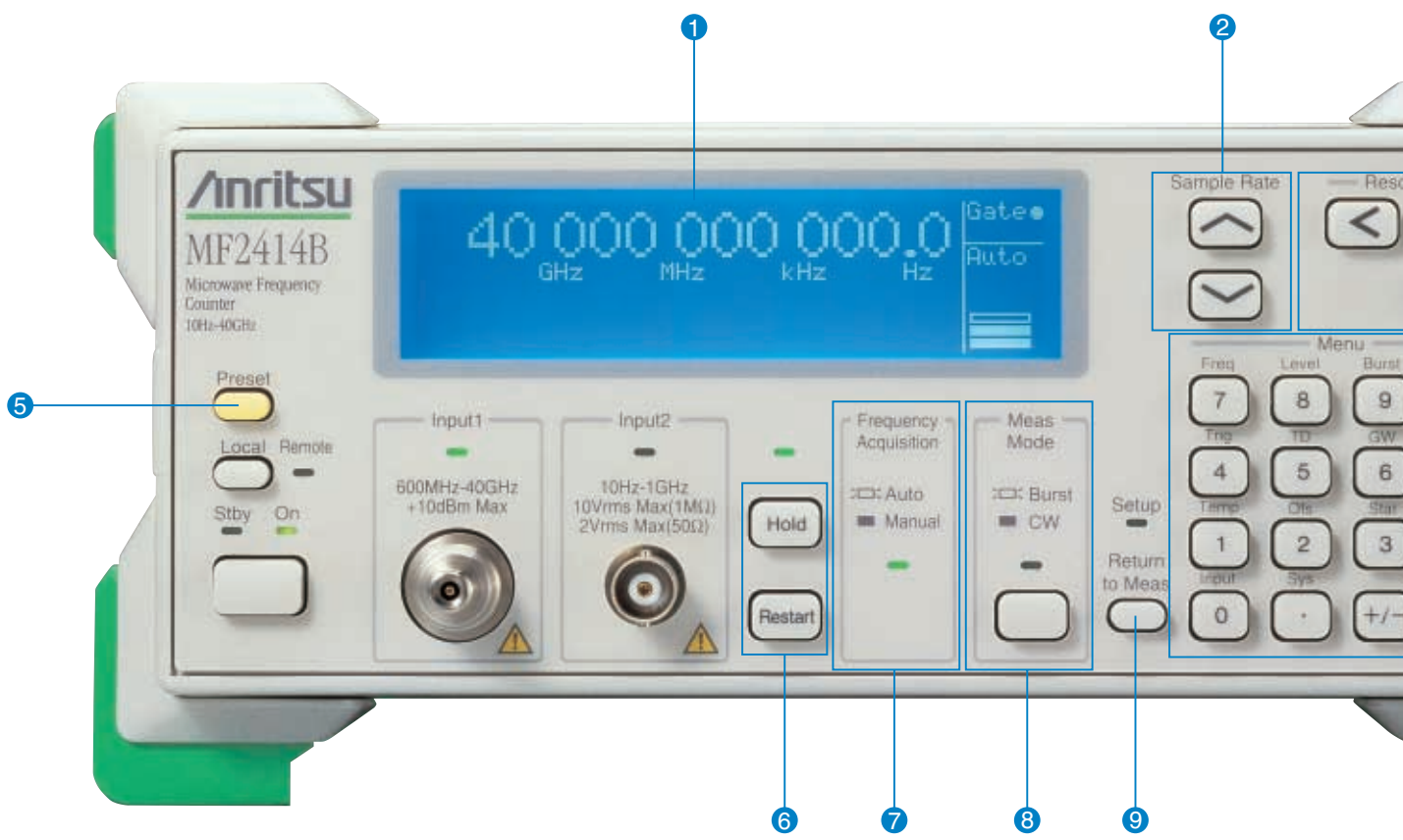
At burst signal measurement, the carrier frequency may be different at the start, middle, and end of the burst.

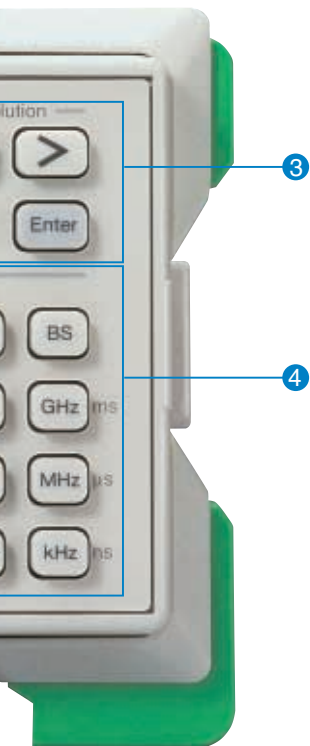
In the MF2400B series, the carrier signal frequency at any position of the signal (delay time from trigger signal leading edge) and at any specified time (gate time) can be measured using a combination of the gating and trigger delay functions.



Save and recall functions added

Up to maximum of 10 setups can be stored in the internal memory, and these can be freely recalled. Storing complex setups in advance, such as burst triggers and gate settings, makes it possible to recall them immediately when needed for measurement, which makes it possible to reduce the measurement setup time and to prevent malfunctions from setup mistakes.





① 248 x 60 dot LCD displaying measurement results and parameter settings.

② **Sample Rate**

Sets measurement off time

③ **Resolution**

At normal measurement, the ◀ and ▶ keys switch the frequency measurement resolution. However, when setting parameters, the ◀ and ▶ keys are used to select the setting item; the selected item is confirmed by pressing the Enter key.

④ **Menu**

This key sets measurement functions such as frequency, level and burst, etc. It automatically changes to the parameter setting condition, and changes numerics and units.

⑤ **Preset**

Pressing this key returns each parameter to the initial setting.

⑥ **Hold, Restart**

The Hold key is used to hold to measured valued. When Hold is ON, the key lamp is lit. The Restart key starts measurement over. When the Restart key is pressed when Hold is ON, the latest data is measured and hold.

⑦ **Frequency Acquisition**

This is used at frequency measurement of Input 1. At Auto, the full frequency band is swept and the frequency of signals exceeding the specified level is measured. At Manual, the preset frequency and the frequency in input allowable frequency range can be measured.

⑧ **Meas Mode**

At Burst, the burst signal width, period and carrier frequency can be measured (not related to Acquisition key setting, and change in to the manual measurement condition). Continuous wave measurement is performed at CW mode.

⑨ **Return to Meas**

Pressing this key after setting parameters, returning the counter to the normal measurement status.

⑩ **Ext Trig Input**

Measures frequency by using external timing signal

⑪ **AUX Output**

Outputs control signal of the measurement function and parameters which are set.



Specifications

MF2400B Series

| Input | Frequency range | INPUT 1 MF2412B: 600 MHz to 20 GHz MF2413B: 600 MHz to 27 GHz MF2414B: 600 MHz to 40 GHz INPUT 2 10 MHz to 1 GHz (50 Ω), 10 Hz to 10 MHz (1 MΩ) | | | | | | | | | | | | | | | | |
|------------------------------------|---|---|------------|--------|-------|--------|---------|--------|---------|-------|------------------|-------|------|-----|--------|-------|------|------|
| | Input level range (sine wave input) | INPUT 1 -33 to +10 dBm (<12.4 GHz), -28 to +10 dBm (<20 GHz), -25 to +10 dBm (<27 GHz), [-44.6 + 0.741 x frequency (GHz)] to +10 dBm (≤40 GHz) INPUT 2 25 mVrms to 2 Vrms (50 Ω), 25 mVrms to 10 Vrms (1 MΩ) | | | | | | | | | | | | | | | | |
| | Impedance, coupling | INPUT 1: 50 Ω, AC couple INPUT 2: 50 Ω or ≥1 MΩ (≤35 pF), AC couple | | | | | | | | | | | | | | | | |
| | Connector | INPUT 1 MF2412B: N-type, MF2413B: SMA-type, MF2414B: K-type INPUT 2: BNC-type | | | | | | | | | | | | | | | | |
| Gating function | Trigger mode | INT: Triggered by measurement signal EXT: Triggered by external signal *Trigger level: 1.5 V ± (2 to 10 Vp-p), Trigger pulse width: ≥1 μs, Impedance: ≥100 Ω, Coupling: DC LINE: Triggered by AC line signal | | | | | | | | | | | | | | | | |
| | Trigger delay | 20 ns to 0.1 s*1, off (≤320 ns in 20 ns steps, and <1 μs in 40 ns steps variable; ≥1 μs in continuously variable as effective two digits) | | | | | | | | | | | | | | | | |
| | Gate width | 100 ns to 0.1 s (<1 μs in 20 ns steps variable; ≥1 μs in continuously variable as effective two digits) | | | | | | | | | | | | | | | | |
| Pulse modulation wave measurement | Frequency range | MF2412B: 600 MHz to 20 GHz MF2413B: 600 MHz to 27 GHz MF2414B: 600 MHz to 40 GHz | | | | | | | | | | | | | | | | |
| | Pulse width | 100 ns to 0.1 s (NARROW), 1 μs to 0.1 s (WIDE) | | | | | | | | | | | | | | | | |
| | Pulse repetition frequency | 10 Hz to 4 MHz (pulse off time: ≥240 ns) | | | | | | | | | | | | | | | | |
| | Carrier frequency measurement*2 | Max. resolution: 10 kHz (pulse width: 100 ns to 1 μs), 1 kHz (pulse width: 1 to 10 μs), 100 Hz (pulse width: 10 to 100 μs), 10 Hz (pulse width: 0.1 to 1 ms), 1 Hz (pulse width: 1 to 10 ms), 0.1 Hz (pulse width: 10 to 100 ms) Measurement time: (T or T _s whichever is greater) x {1/(f _r x TGW)} ² *3 <table border="1"> <thead> <tr> <th>Resolution</th> <th>1 Hz</th> <th>10 Hz</th> <th>100 Hz</th> <th>1 kHz</th> <th>10 kHz</th> <th>100 kHz</th> <th>1 MHz</th> </tr> </thead> <tbody> <tr> <th>Measurement time</th> <td>200 s</td> <td>20 s</td> <td>2 s</td> <td>200 ms</td> <td>20 ms</td> <td>5 ms</td> <td>5 ms</td> </tr> </tbody> </table> *Measurement carrier frequency: 1 GHz (TGW*3 = 0.1/f _r) Accuracy: ±1 count ±time base accuracy x measurement frequency ±trigger accuracy ±residual error*5 ±1/TGW*3 | Resolution | 1 Hz | 10 Hz | 100 Hz | 1 kHz | 10 kHz | 100 kHz | 1 MHz | Measurement time | 200 s | 20 s | 2 s | 200 ms | 20 ms | 5 ms | 5 ms |
| | Resolution | 1 Hz | 10 Hz | 100 Hz | 1 kHz | 10 kHz | 100 kHz | 1 MHz | | | | | | | | | | |
| Measurement time | 200 s | 20 s | 2 s | 200 ms | 20 ms | 5 ms | 5 ms | | | | | | | | | | | |
| Pulse width measurement | Resolution: 1 ns Accuracy: ±20 ns ±time base accuracy x measurement pulse width ±trigger accuracy Unit indication: μs (fixed) | | | | | | | | | | | | | | | | | |
| Pulse period measurement | Resolution: 1 ns Accuracy: ±20 ns ±time base accuracy x measurement period ±trigger accuracy Unit indication: μs (fixed) | | | | | | | | | | | | | | | | | |
| Carrier wave frequency measurement | Resolution, gate time | INPUT 1 NORMAL: 1 MHz/1 μs to 0.1 Hz/10 s FAST: 1 MHz/0.18 μs to 0.1 Hz/1.8 s (typical) INPUT 2 10 MHz to 1 GHz (50 Ω): 1 MHz/1 μs to 0.1 Hz/10 s 10 Hz to 10 MHz (1 MΩ): Shown below | | | | | | | | | | | | | | | | |
| | Measurement accuracy | INPUT 1 NORMAL: ±1 count ±time base accuracy x measurement frequency ±residual error*4 FAST: ±1 count ±time base accuracy x measurement frequency ±trigger accuracy ±residual error*5 INPUT 2 10 MHz to 1 GHz: ±1 count ±time base accuracy x measurement frequency 10 Hz to 10 MHz: ±1 count ±time base accuracy x measurement frequency ±trigger accuracy | | | | | | | | | | | | | | | | |

| | |
|---|---|
| Auto/manual measurement | Auto FM tolerance: 35 MHzp-p, Acquisition time: ≤50 ms Manual (CW measurement) Input allowable frequency range: ±30 MHz (600 MHz to 1 GHz), ±40 MHz (≥1 GHz) Acquisition time: ≤15 ms Manual (Burst measurement) Input allowable frequency range: ±30 MHz (600 MHz to 1 GHz, pulse width mode: WIDE) ±20 MHz (≥1 GHz, pulse width mode: NARROW) ±40 MHz (≥1 GHz, pulse width mode: WIDE) Acquisition time: ≤15 ms |
| Functions | Template: Inputs in upper/lower limit of frequency, judged on GO/NO-GO Frequency offset: +offset, -offset, ppm Statistical processing: mean, maximum, minimum, p-p Save/recall: 10 panel settings (max) |
| AUX output | Output for GO/NO-GO, count end, input level detection, internal gating, restart, and acquisition signal |
| Sample rate | 1 ms to 10 s (1-2-5 steps), hold |
| High-speed sample period/frequency resolution | INPUT 1: 10 μs/10 kHz, 100 μs/1 kHz, 1 ms/100 Hz INPUT 2: 10 μs/100 kHz, 100 μs/10 kHz, 1 ms/1 kHz ★Measurement frequency : 100 MHz |
| Memory back up | Store in non-volatile memory at instrument power-down |
| Display | Display digits: 12 digits and 1 digit (- mark) LCD: 248 x 60 dots (with back light) |
| Reference crystal oscillator | Frequency: 10 MHz Warm-up: ≤±5 x 10 ⁻⁹ /day (after 30 min. warm-up) Aging rate: ≤±2 x 10 ⁻⁸ /day (after 24 h warm-up) Temperature characteristics: ±5 x 10 ⁻⁸ (0° to 50 °C) |
| External reference input | 1/2/5/10 MHz, Input voltage: 1 to 5 Vp-p (AC coupling), Input impedance: ≥1 kΩ |
| External reference output | 1/2/5/10 MHz* ⁶ , Output voltage: ≥2 Vp-p (open end, AC coupling), Output impedance: ≤400 Ω |
| External control | GPIO (conforms to IEEE488.2 standards): SH1, AH1, T5, L4, SR1, RL1, PPO, DC1, DT1, C0, E2 |
| Power | 85 to 132/170 to 250 V (auto switch), 47.5 to 63 Hz, ≤80 VA |
| Operating temperature | 0° to 50 °C |
| Dimensions and mass | 213 (W) x 88 (H) x 350 (D) mm, ≤5 kg |
| EMC | EN61326: 1997/A1: 1998 (Class A), EN61000-3-2: 1995/A2: 1998 (Class D) EN61326: 1997/A1: 1998 (Annex A) |
| LVD | EN61010-1: 1993/A2: 1995 (Installation Category II, Pollution Degree 2) |

*1 Delay time until counter started by trigger detection

*2 MANUAL measurement mode

*3 f_r: frequency resolution, TGW: gate width, T_s: processing time (50 μs), T: period (2/f_r)

*4 Measurement frequency (GHz)/10 count (rms)

*5 Measurement frequency (GHz)/2 count (rms)

*6 10 MHz when using internal reference signal; outputs signal based on this signal (1/2/5/10 MHz) when using external reference signal

● Options 01/02/03: Crystal oscillator

| Option number | 01 | 02 | 03 |
|-----------------------------|---|---|--|
| Frequency | 10 MHz | | |
| Aging rate | 5 x 10 ⁻⁹ /day, 5 x 10 ⁻⁹ /month, 7.5 x 10 ⁻⁸ /year ★After power on, with reference to frequency after 24 h | 2 x 10 ⁻⁹ /day, 3 x 10 ⁻⁹ /month, 4.5 x 10 ⁻⁸ /year ★After power on, with reference to frequency after 24 h | 5 x 10 ⁻¹⁰ /day, 1 x 10 ⁻⁹ /month, 1.5 x 10 ⁻⁸ /year ★After power on, with reference to frequency after 48 h |
| Temperature characteristics | ±5 x 10 ⁻⁸ | ±1.5 x 10 ⁻⁸ | ±5 x 10 ⁻⁹ |
| | -10° to 60 °C (with reference to 25 °C) | | |

Ordering information

Please specify model/order number, name and quantity when ordering.

| Model/order No. | Name | Remarks |
|--|---|--|
| MF2412B MF2413B MF2414B | <p>– Main frame –</p> Microwave Frequency Counter Microwave Frequency Counter Microwave Frequency Counter | 10 Hz to 20 GHz, N-J connector 10 Hz to 27 GHz, SMA-J connector 10 Hz to 40 GHz, K-J connector |
| F0012 W1520AE | <p>– Standard accessories –</p> Power cord, 2.5 m: 1 pc Fuse, 3.15 A: 2 pcs MF2412B/2413B/2414B operation manual: 1 copy | |
| MF2412B-01 MF2413B-01 MF2414B-01 MF2412B-02 MF2413B-02 MF2414B-02 MF2412B-03 MF2413B-03 MF2414B-03 | <p>– Options –</p> Crystal oscillator (5 x 10 ⁻⁹ /day) Crystal oscillator (5 x 10 ⁻⁹ /day) Crystal oscillator (5 x 10 ⁻⁹ /day) Crystal oscillator (2 x 10 ⁻⁹ /day) Crystal oscillator (2 x 10 ⁻⁹ /day) Crystal oscillator (2 x 10 ⁻⁹ /day) Crystal oscillator (2 x 10 ⁻⁹ /day) Crystal oscillator (5 x 10 ⁻¹⁰ /day) Crystal oscillator (5 x 10 ⁻¹⁰ /day) Crystal oscillator (5 x 10 ⁻¹⁰ /day) | |
| K224B*1 34RKNF50 J0526 J0527 J0127A J0853 J0854 MP612A*2 MP613A*2 J0007 J0008 B0426A B0409 B0329L J0060 B0390G B0411A ERV713-H J0997 | <p>– Optional accessories –</p> Coaxial adapter (K-P•K-J, SMA compatible) Coaxial adapter (ruggedized K-P•N-J) Coaxial adapter (N-J•SMA-J) Coaxial cord (K-P•K-P), 2 ft Coaxial cord (BNC-P•RG-58A/U•BNC-P), 1 m Coaxial cord (N-P•SF104P•N-P), 2 m Coaxial cord (APC3.5-P•SF104P•APC3.5-P), 2 m Fuse Holder (N-P•N-J) Fuse Element GPIB cable, 1 m GPIB cable, 2 m Carrying bag Carrying case Protection cover Coaxial adapter (N-J•SMA-P) Rack mount kit Rack mount kit Portable power supply Adapter | DC to 40 GHz, SWR: 1.2 DC to 20 GHz, SWR: 1.25 DC to 1 GHz DC to 1 GHz, Power rating: +17 dBm, Blow rating: ≥+35 dBm Soft type With B0329L protection cover 19 inch type, one unit 19 inch type, two units, side by side Matsushita product For portable power supply |

*1: The K224 adapter is used to prevent damage to the input connector.

*2: The MF2400B series has the MP612A Fuse Holder (with MP613A Fuse Element) to prevent input of excessive power.

In addition, the MP612A Fuse Holder has an N-type connector, so an adapter is required according to the coupled connector type.

Specifications are subject to change without notice.

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