marconi instruments

2440

20 GHz
MICROWAVE COUNTER

Operating Manual

Chapter 1

GENERAL INFORMATION

CONTENTS

Fig. 1 20 GHz Microwave Counter type 2440

FEATURES

1. The 2440 is a frequency counter intended primarily for microwave use but offering continuous frequency measurement over the range 10 Hz to 20 GHz. Frequency cover is divided between three input channels A, B and C which accept 10 Hz to 100 MHz, 50 MHz to 600 MHz and 600 MHz to 20 GHz respectively. The instrument employs the principle of harmonic heterodyne frequency conversion under microprocessor control and has good sensitivity and dynamic range with short gate times and high resolution. This system also has wide f.m. tolerance and short signal acquisition times.

2. The measurement is displayed on nine 7-segment l.c.d. digits with annunciators giving the frequency units and other supporting information relating to the instrument's status. The accuracy of measurement is dependent only on the time base over most of the frequency range and depends on which of three alternative crystal oscillators has been installed. The crystal oscillator remains active independent of the front panel supply switch thereby maintaining temperature stability and accuracy.

3. Resolution is controlled by a group of keyswitches in decade steps from 0.1 Hz to 10 kHz with automatic positioning of the decimal point and indication of overflow. On input C, an immediate display of the overflow decades is available allowing all 12 digits to be seen. In the AUTO resolution mode, the gate time is automatically lengthened up to a maximum of 1 s in order to fill all 9 digits of display without overflow.

4. The rate at which the display is up-dated can be varied from 8 readings/s to 1 reading every 20 s by two keyswitches. Other major functions of the 2440 include an OFFSET mode in which the measured frequency may be added to or subtracted from the numerical offset entered into the instrument either via the keyboard or from a previous measurement. A low-pass filter can be introduced into the 'A' channel in order to reduce the noise bandwidth when low frequencies are to be measured. A range of automatic self test and diagnostic routines can be brought into action via the RESET key.

5. The GPIB interface unit permits full remote operation of all the functions (except the supply switch) via the General Purpose Interface Bus (GPIB).*

6. A 12 bit digital to analogue converter module, available as an optional accessory, may be fitted in place of the GPIB unit. This provides an analogue voltage output of any three consecutive digits from the maximum of 12 decades of frequency data available within the instrument.

7. Other accessories provide a comprehensive range of servicing and operating aids.

**GPIB - Marconi Instruments General Purpose Interface Bus in accordance with IEEE Standard 488 - 1978 and IEC Publication 625-1.*

PERFORMANCE DATA

Characteristic	*Performance*
8. Input	Three channels, switch selected covering the frequency range 10 Hz to 20 GHz.
Input Channel A	
Frequency range :	10 Hz to 100 MHz direct count.
Sensitivity :	30 mV r.m.s. sine wave from 10 Hz to 10 MHz. 50 mV r.m.s. sine wave from 10 MHz to 50 MHz. 100 mV r.m.s. sine wave from 50 MHz to 100 MHz.
Maximum input :	250 V r.m.s. at 50 Hz decreasing by approx. 2.45×10^{-6} V/Hz to 5 V r.m.s. at 100 MHz.
Input impedance :	Greater than 1 MΩ in parallel with less than 25 pF. AC coupled via 0.1 µF.
Connector :	Type BNC female.
Input filter :	Switchable low pass filter reduces sensitivity above 5 kHz to improve noise immunity when measuring l.f. signals. Attenuation is at least 18 dB above 1 MHz.
Input Channel B	
Frequency range :	50 MHz to 600 MHz direct count.
Sensitivity :	-20 dBm (50 MHz to 500 MHz). -15 dBm (500 MHz to 600 MHz).
Maximum input :	+13 dBm (1 V r.m.s. p.d. into 50 ohms).
Damage level :	+27 dBm (5 V r.m.s. p.d. into 50 ohms).
Input impedance :	50 Ω nominal.
Connector :	Type BNC female, AC coupled via 1 nF.
VSWR :	2 : 1 typical.
Input Channel C	
Frequency range :	600 MHz to 20 GHz.
Sensitivity :	-25 dBm (600 MHz to 12 GHz). -20 dBm (12 GHz to 18 GHz). -15 dBm (18 GHz to 20 GHz).
Maximum input :	+3 dBm (600 MHz to 2 GHz). +5 dBm (2 GHz to 20 GHz).

Characteristic	*Performance*
Damage level :	+27 dBm.
Input impedance :	50 Ω nominal.
Connector :	Precision type N female.
VSWR :	2.5:1 typical (600 MHz to 18 GHz).
FM tolerance :	30 MHz p-p typical from 2 GHz to 20 GHz. For modulation frequencies up to 10 MHz.
AM tolerance :	Up to 40% modulation depth for signals within the sensitivity range.
Amplitude discrimination :	10 dB for two signals within 500 MHz. 20 dB for two signals >500 MHz over the band.
Acquisition time :	200 ms typical (600 MHz to 20 GHz).

9. Keyboard and displays

Functions :

CHANNEL A/B OR C	Toggles between channels A & B or C.
RESOLUTION	Six buttons select resolution in decade steps from 0.1 Hz to 10 kHz.
AUTO	Autoranges resolution.
DISPLAY RATE	Increments/decrements display rate. Range from 8 reading/s to 1 reading every 20 s.
ON/OFF	Enables and disables offset frequency.
SET	Displays and/or selects offset frequency.
+/-	Adds or subtracts offset frequency.
LPF	Toggles between low-pass filter on and off.
RESET	Resets instrument and allows entry to internal self test modes.
LOCAL	Returns to front panel control (if GPIB in remote and not in local lockout).

Displays : Nine digit liquid crystal display with annunciators to show frequency units, external frequency standards, overflows, offsets and remote GPIB operation. Decimal point is automatically selected and leading zeros are suppressed. The displays and LEDs may be checked using an internal self test.

Characteristic	*Performance*
	In channel C, digits that have caused an overflow may be revealed by pressing "C" again.

10. Accuracy

Basic accuracy :	±1 count ± frequency standard error.
Frequency standard :	Internal 10 MHz crystal oscillator or external input automatically selected. Application of external signal overrides the internal oscillator. The EXT indicator shows when the external standard is in operation.
Residual stability :	$\pm \frac{(\text{Frequency in GHz})}{10}$ counts r.m.s.

External standard input

Frequency :	1 MHz or 10 MHz sine wave or square wave.
Input level :	150 mV r.m.s. minimum up to 3 V r.m.s. maximum.
Input impedance :	10 kΩ (approx.) a.c. coupled.

11. Internal standard

Adjustment range :	A control accessible through the rear panel allows adjustment of the internal standard to compensate for ageing.

Stability

20 GHz Microwave Counter 2440A - version code no. 52440-301C and -304K with temperature compensated crystal oscillator.

Temperature :	Better than ±1.5 p.p.m. over the operating temperature range of 0 to 50°C.
Ageing rate :	Better than ±1 p.p.m. nominal per year after 1 month continuous use.

20 GHz Microwave Counter 2440A - version code no. 52440-302R and -305A fitted with oven controlled crystal oscillator.

Temperature :	Better than ±0.1 p.p.m. over the operating temperature range of 0 to 50°C.
Ageing rate :	Better than ±1 p.p.m. per year after 1 month continuous use.
Warm-up time :	Within 0.2 p.p.m. of final frequency within 10 min. from switch-on at 20°C ambient.

Characteristic	*Performance*
Auxiliary output :	Internal 10 MHz standard available at 1 MHz or 10 MHz via rear panel BNC socket.
Level :	Greater than 1 V p-p into 50 Ω (approximately 4 V p-p e.m.f.).
Impedance :	Approximately 500 Ω.
▶ 12. External trigger mode	Enables counter to make one measurement when triggered by an external device. Also allows interface to appropriate sweeper for start, stop and marker frequency measurements.
External trigger input :	TTL type low level or contact closure to ground. Pulse width to be greater than 30 µs.
Sweep inhibit output :	TTL type low level within 30 µs of trigger input. ◀
13. GPIB interface unit	A GPIB interface is fitted as standard. All functions except the supply switch are remotely programmable.
Capabilities :	Complies with the following subsets as defined in IEEE 448 - 1978:- SH1,AH1,T5,L4,SR1,RL1,PP0,DC1,DT1,C0 and E1. (Marconi Instruments General Purpose Interface Bus is in accordance with IEEE Standard 488 - 1978 and IEC Publication 625-1, first edition).
▶ 14. Digital to analogue converter module option	A digital to analogue (DAC) interface is available as an accessory for the user to fit. The DAC converts three consecutive digits from the display.
Level :	-1 V to +1 V.
Resolution :	1 mV. ◀
15. Power requirements	
Voltage ranges : (switchable)	105 V to 120 V 210 V to 240 V ±10%.
Frequency range :	50 Hz to 400 Hz ±10%.
Consumption :	50 VA max.
16. Environmental	
Rated range of use temperature :	0°C to +50°C.
Limit range of operation temperature :	0°C to +55°C.

Characteristic		*Performance*
Conditions of storage and transport :		
	Temperature :	-40°C to +70°C.
	Humidity :	Up to 90% relative humidity.
	Altitude :	Up to 2500 m (pressurized freight at 27 kPa differential, i.e. 3.9 lbf/in²).
17. Safety		Complies with IEC 348.
18. Radio frequency interference		This equipment conforms to the requirements of EEC Directive 76/889.
19. Dimensions and weight		
	Height :	108 mm (4.25 in).
	Width :	215 mm (8.5 in) without handle. 256 mm (10.1 in) with handle.
	Depth :	338 mm (13.3 in).
	Weight :	5.5 kg (12 lb).

ACCESSORIES

20. Supplied

AC supply lead	43129-003W
Polythene cover	37490-435X
Operating Manual H 52440-900N, Vol. 1	46881-486G
GPIB instructions card	46881-551Y

21. Optional

GPIB lead assembly, 1 m, IEEE connectors	43129-189U
IEEE/IEC adapter block, IEEE male to IEC female	46883-408K
Digital to analogue converter module option	54414-001S
Front panel cover (stowage)	54124-022L
Extender card (processor)	46883-644C
Extender card	46883-645R
Flexible cable assembly 18 GHz, 500 mm, N male-N male	54351-022X
Flexible cable assembly 18 GHz, 500 mm, SMA male-SMA male	54351-023M
Adapter Precision co-ax N male-SMA female	54311-094M
Attenuator 10 dB, 5 W, type 6534/3 Attenuator 20 dB, 5 W, type 6534/4	
Accessory box	46883-666S
Spanner tubular (service aid)	46883-726Y
Rack mounting kit - single unit	46883-638P
Rack mounting kit - double unit	46883-536P
Blank frame unit	46883-537X
Service Manual H 52440-900N, Vol. 2	46881-487V
GPIB Manual H 54811-010P	46881-365R