3. INTRODUCTION

The Farnell PSG2400A is a portable synthesized signal generator covering the frequency range 100kHz to 2.4GHz with a full +19/+16dBm to -143 dBm output level range. This range covers virtually all radio services in the MF, HF, VHF, UHF bands and also L band microwave. Designed to operate from any standard AC supply or from 12V DC (24V option) the compact lightweight unit is ideal for bench, field or system use. The GPIB interface for system use conforms to the IEEE 488.2 standard. Reverse power protection to 25 Watts safeguards the RF output from accidental damage.

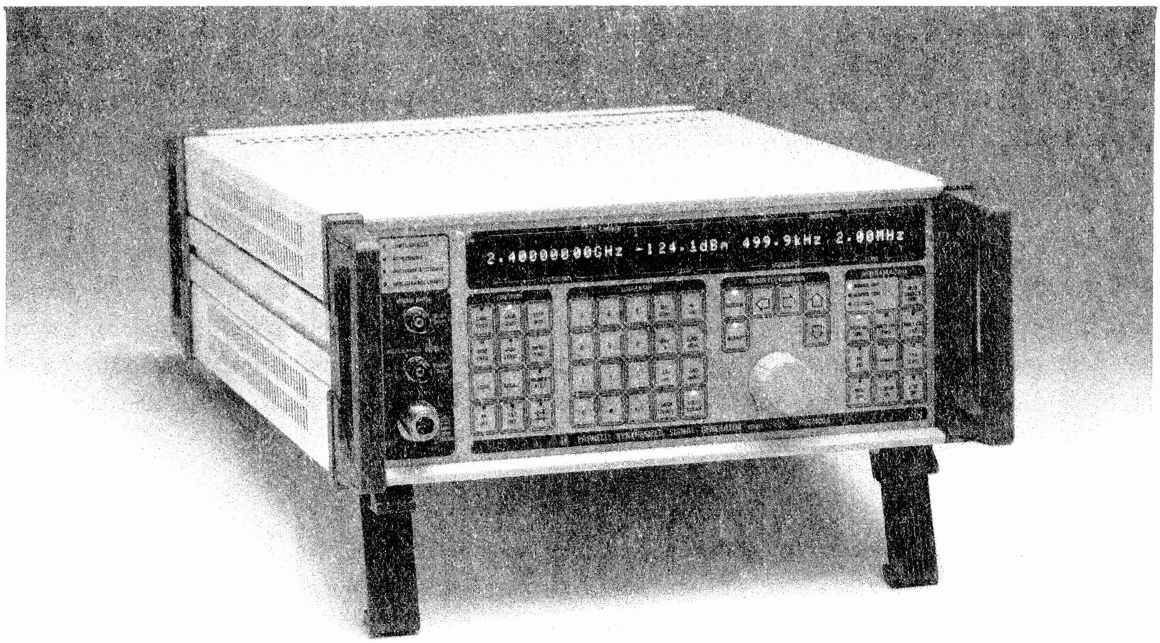
Front panel control is by a tactile membrane switch assembly, completely sealed against the ingress of moisture and dust, and incorporating an EMC shield. A high visibility 40 character alphanumeric LED display is used to indicate carrier frequency, carrier level, modulation frequency and modulation level settings simultaneously. The addition of a rotary control enables displayed data to be conveniently adjusted in integer steps of any resolvable size.

The entire parameters of the last front panel settings and 99 user defined set ups are retained in non-volatile memory following a power break. Individual memories are available for recall or store and protect, with a memory step facility incorporated to enable rapid switching between pre-determined tests. Automatic conversion calculations are performed by the microprocessor enabling carrier level to be entered and displayed in the various units of dBm, dBμV, μV, mV, V pd or μV,mV,V emf.

Comprehensive modulation capability is provided internally with two wide band 0.1Hz to 500kHz audio synthesizers fitted as standard. These sources may be mixed internally to produce complex modulation waveforms for the testing of CTCSS, DTMF and SELCALL systems. In addition to the usual 5 tone SELCALL systems, the user may also define unique tone bursts with up to 16 consecutive tones. The last used tone sequence is also stored in non-volatile memory. The wide modulation bandwidth extends to DC for low rate digital modulation applications, and simultaneous AM/FM(ØM) is permissible.

An internal 1kHz distortion analyser is a standard feature allowing SINAD sensitivity tests to be performed on mobile radios, thus enabling rapid and consistent alignment checks to be made. The SINAD signal to noise ratio is displayed to a resolution of 0.1dB, with the facility of user defined digital averaging.

Extra features include a secondary function key for access to special facilities and digital sweep of displayed data with the ability to set start, stop points and the total sweep time. The instrument's low power consumption allows field operation from an optional 12V rechargeable external add-on battery pack. Other options include a high stability crystal reference and pulse modulation.



4. SPECIFICATION

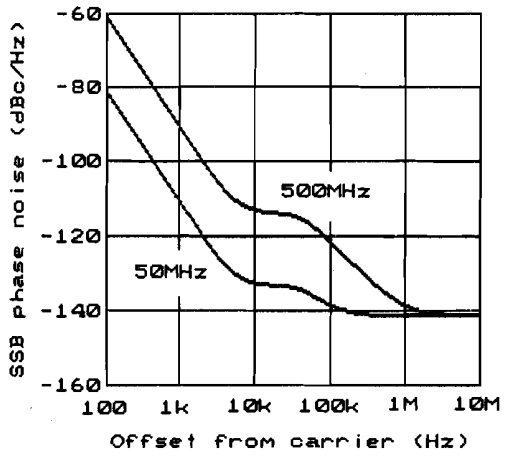
FREQUENCY

Range	100kHz to 2.4GHz. Extended range 50kHz to 2.5GHz (with error limits removed).
Resolution	5Hz (carrier 100 kHz to <37.5MHz), 1Hz (carrier 37.5MHz to <75 MHz), 2Hz (carrier 75 MHz to <150 MHZ), 5Hz (carrier 150 MHz to <600 MHz), 10Hz (carrier 600 MHz to <1.2 GHz), 20Hz (carrier 1.2 GHz to 2.4 GHz).
Stability (standard)	$\pm 1E^{-6}$ (0 to +55°C), $\pm 2E^{-7}$ per month.
(option O)	$\pm 2E^{-7}$ (0 to +40°C), $\pm 8E^{-8}$ per month during first year, $\pm 4E^{-8}$ per month after first year.

RF OUTPUT

Range	-143.0dBm to + 16dBm, (0.016μV to 1.41V rms pd). Overrange to +19dBm (carrier <600MHz).
Resolution	0.05dB (carrier $\geq$-100dBm), 0.1dB (carrier <-100dBm).
Units	dBm, dBμV, V, mV, μV (pd).
Absolute level accuracy	±1dB for carrier levels of +4dBm to +16dBm. For carrier levels of -127dB to <+4dBm: ±1.5dB (carrier <1.2GHz), ±2.5dB (carrier $\geq$1.2GHz). For carrier levels of <-127dBm: ±3.0dB, typical.
Source impedance	50Ω.
VSWR	<1.5:1 (carrier <+4dBm).

Third order intermodulation (modulation off)	<-50dBc for carrier levels of ≥+4dBm with two PSG2400A signal generators combined in a resistive 6dB coupler (carrier separation ≥5kHz). <-60dBc for carrier levels of <+4dBm.
Reverse power protection	25W maximum (from 50Ω source), 100kHz to 2.4GHz, user reset. 25V DC maximum.
Trip level	100mW typical.
SPECTRAL PURITY	For carrier levels of <+10dBm.
Harmonics	<-30dBm.
Sub-harmonics	<-70dBc (carrier <1.2GHz), <-30dBc (carrier ≥1.2GHz).
Non-harmonic spurious	<-60dBc at carrier offsets ≥3kHz.
Residual FM	<20Hz rms at 2.4GHz (CCITT P53A weighting) reducing by 6dB/octave to <0.625Hz rms at 37.5MHz, <2.5Hz rms below 37.5MHz.
Residual AM	<0.1% rms, 50Hz to 15kHz bandwidth.
SSB phase noise	Typical characteristics shown for carrier frequencies of 50 and 500 MHz.



Noise floor	<-135dBc/Hz.

AM on 20kHz FM	<0.5% at 1kHz rate, 50Hz to 15kHz bandwidth.
FM on 30% AM	<200Hz at 1kHz rate, 50Hz to 15kHz bandwidth.
Carrier leakage	<0.5μV (2 turn 25mm loop, 25mm away).

AMPLITUDE MODULATION

For carrier levels of <+10dBm:

Depth	0 to 99.9%. AM depth reduces in a linear fashion from 99.9% at <+10dBm to 10% at +15.0dBm .
Resolution	0.1%.
Accuracy	All at 1kHz rate: ±5% of reading up to 90% depth,(carrier <600MHz), ±15% of reading up to 50% depth,(carrier ≥600MHz).
Modulation response	Relative to 1kHz rate: Internal: ±1dB 0.1Hz to 50kHz, External: ±1dB 50Hz to 50kHz, ±1dB DC to 50kHz (DCFM selected), -3dB typical at 100kHz, up to 50% depth.
Distortion (THD)	All at 1kHz rate, 50Hz to 15kHz bandwidth: <1% up to 30% depth (carrier <600MHz), <3% up to 80% depth (carrier <600MHz), <5% up to 50% depth (carrier ≥600MHz).

FREQUENCY MODULATION

Maximum peak deviation	100kHz to <37.5MHz, 250kHz, 37.5MHz to <75MHz, 62.5kHz, 75MHz to <150MHz, 125kHz, 150MHz to <300MHz, 250kHz, 300MHz to <600MHz, 500kHz, 600MHz to <1.2GHz, 1MHz, 1.2GHz to 2.4GHz, 2MHz. Extended range of 5x the above, (with error limits removed).
Resolution	10Hz (<10kHz peak), 100Hz (<100kHz peak), 1kHz (<1MHz peak), 10kHz (≥1MHz peak).

Accuracy	±5% of reading at 1kHz rate, excluding residual FM.
Modulation response	Internal/external relative to 1kHz rate: ±1dB 50Hz to 100kHz, ±1dB 0.1Hz or DC to 100kHz (DCFM selected), ±3dB up to 500kHz.
Distortion (THD)	All at 1kHz rate, 50Hz to 15kHz bandwidth: <0.5% up to 10kHz peak deviation, <1% up to 100kHz peak deviation, <2% up to maximum peak deviation typical.
DCFM frequency drift	After 30 minutes warm up and under constant ambient temperature conditions <±250Hz/10 minutes at 100MHz, typical.
DCFM frequency offset	<±150Hz at 100MHz, typical.
WIDEBAND FM	Using the external modulation input, (no internal level adjustment).
Bandwidth (6dB)	50kHz to 10MHz.
Impedance	50Ω nominal.
Sensitivity	1V peak for maximum peak deviation, (see frequency modulation).
PHASE MODULATION	
Deviation	0 to 9.99 rads.
Resolution	0.01 rad.
Accuracy	±10% of reading at 1kHz rate, excluding residual PM.
Modulation response	Internal/external relative to 1kHz rate: ±2dB 100Hz to 10kHz.
Distortion	<2% at 1kHz rate,300Hz to 3kHz bandwidth.

INTERNAL MODULATION (SOURCE ONE AND TWO)

Synthesizer range	0.1Hz to 500kHz.
Resolution	0.1Hz, frequency <1kHz, 1Hz, frequency <10kHz, 10Hz, frequency <100kHz, 100Hz, frequency ≥100kHz.
Waveform	Sine or square.
Accuracy	As internal standard.
Distortion (THD)in sinewave mode	<0.2% at 1kHz rate (50Hz to 15kHz bandwidth), <2% for rates <100kHz, <3% up to 500kHz rate, typical.

MODULATION OUTPUT

Fixed level	1V rms into 50Ω.
Variable level	0 to 1V rms in 1mV steps, into 50Ω.
Accuracy	±5% of reading for levels ≥100mV rms, at 1kHz rate.
Source impedance	50Ω nominal.
Distortion	As internal modulation source, (load impedance ≥ 10kΩ).

MODULATION SYSTEMS

User defined tones	User defined tone frequencies and durations with up to 16 consecutive tones.
SELCALL	CCIR, EEA, ZVEI, DZVEI, EIA and NATEL standards selectable.
DTMF	The standard low group/high group matrix tones are generated internally.
CTCSS	The audio synthesizers may be mixed internally or with an external input, both levels independantly adjustable.
Simultaneous modulation	AM plus FM or phase modulation, modulation levels independantly adjustable.

EXTERNAL MODULATION

Impedance	>5kΩ.
Level	1V peak for calibration.
Indication	Four digit display,range 0 to 1.000Vrms.
Simultaneous tones	The external input may be mixed with either or both internal sources.

SINAD

Input frequency	1kHz ± 1Hz.
Input level	30mV to 3V rms.
Impedance	≥10kΩ.
Indication	Three digit logarithmic display (true rms detection), with user defined digital averaging. Usable range 0 to 40dB.
Resolution	0.1dB.
Bandwidth	Wideband, 60Hz to 6kHz (-3dB) or CCITT P53A weighting.

SWEEP

Functions	Carrier frequency, carrier level, modulation frequency, modulation level.
Range (start, stop)	Any within setting range.
Total sweep time	1 to 999 seconds.
Sweep sync output	Available on back panel auxiliary socket. Analogue ramp proportional to sweep position with a range of 0 to +10V nominal corresponding to sweep start, stop respectively.

GENERAL

Programmability	GPIB (IEEE 488.2). Functions supported: SH1, AH1, T6, TEO, L4, LEO, SR1, RL1, PPO, DC1, DT0, CO, E2. Setting time (after receipt of last GPIB character): <200ms typical, to within 100Hz of final carrier frequency. <100ms typical, for carrier level and modulation functions.
Memory (non-volatile)	100 complete front panel set ups including last front panel settings. IEEE-488 address.
Internal crystal reference	TCXO, 10MHz.
Internal reference output	0.6V pk-pk into 50Ω, nominal.
External reference frequency	10MHz.
External reference level	0.3 to 3V pk-pk.

POWER REQUIREMENT

AC input	100, 120, 220, 240V AC ±10% 45 to 440 Hz.
DC input (standard)	11.5 to 15V DC.
(option A)	23 to 30V DC.
Consumption	50VA maximum.

ENVIRONMENT

Temperature (operating)	0 to +55°C.
(storage)	-40 to +70°C.
Relative humidity	95% to +40°C non-condensing.
Vibration	5 to 150Hz at 2G sinusoidal, 15 minutes in each of 3 orthogonal planes.
Shock	10 off 25mm drops on each of 6 faces.
Safety	Designed to meet the requirements of IEC publication 348 (BS4743).
EMC	Designed to meet European Standards EN 50 081-1 (generic emission) and EN 50 082-1 (generic immunity).

MECHANICAL (Approximate information).

Height (including feet)	145mm.
Width	330mm.
Depth	520mm.
Weight	14.5kg.

PULSE MODULATION OPTION

Frequency range	100kHz to 2.4GHz.
Carrier on/off ratio	≥60dB.
Rise/fall times	<25ns.
Simultaneous modulation	Pulse modulation may be used in conjunction with any combination of AM, FM (phase modulation) or wideband FM.

RF output level	All carrier level specifications reduced by 3dB. Minimum carrier level -143.0dBm. For example: Maximum level reduced from +16dBm to +13dBm, and spectral purity/amplitude modulation specifications apply for carrier levels of < +7dBm.
Minimum pulse width	50ns.
Maximum pulse repetition frequency	10MHz.
External control (via back panel BNC)	TTL High = carrier on, TTL Low = carrier off. +5V peak maximum.

ACCESSORIES SUPPLIED

Part Number	Description
HC22V2	Detachable AC power cable.
TR201A	N to BNC adaptor.
HC0264	BNC to BNC coaxial cable.
TG212	DC input plug.
HW3114003	Extractor for power selector.
9HPSG2400A	Instruction/service manual.

ORDER CODES/OPTIONS/ACCESSORIES

Standard model

1ERPSG2400A	PSG2400A Portable Signal Generator.

Factory fitted optional versions

1ERPSG2400A/A	As standard but 23 to 30V DC input.
1ERPSG2400A/F	RF output moved to rear panel.
1ERPSG2400A/M	Adds pulse modulation.
1ERPSG2400A/O	High stability frequency reference.

Accessories

1EXA10120	Rechargeable 12V 4Ah add-on battery pack for use with standard 11.5 to 15V DC input only.
15A20100	Rack mounting kit.
1EXA20180	Protective padded carrying case.
1ERA30320	Remote operation foot switch.

Farnell Instruments Limited reserves the right to amend specifications without notification.