



Unique product offering full signal generator functionality with high performance in a VXI module

- Wide frequency coverage:- 9 kHz to 2.4 GHz
- Sweep mode
- Reverse power protection to 50 W
- Simultaneous two tone generation
- Sine, triangular and square wave modulation source
- Modulation capabilities:- Amplitude, frequency, phase, pulse, FSK
- Soft front panel interface
- VXI plug & play compatible
- LabView and LabWindows drivers
- -137 dBm to +25 dBm RF output

The 3002, with its wide frequency coverage from 9 kHz to 2.4 GHz, internal modulation source and built-in attenuator, packs into only 2 C-sized VXI slots, not a signal source, but a fully fledged, high functionality signal generator.

To ensure ease of use, the instrument has been designed to be fully compatible with the requirements of the IEEE 1155 specification and those of the VXI plug & play Systems Alliance. Software drivers and a simple 'soft front panel' interface, allow the module to be easily programmed, with parameters changed via keyboard and mouse.

The signal generator is suitable for a wide range of applications in the laboratory and production where an alternative to rack and stack systems is advantageous.

Operation

The 3002 is a message-based instrument and can be programmed using software drivers or by direct sending of ASCII strings to the instrument. Settings of frequency only, or of the full instrument, can be stored in memory allowing recall simply by memory number. Features which provide enhanced operation include non-volatile memories, memory sequencing and the use of VXI triggers for progressing test sequences.

Frequency selection

Frequency resolution of 1 Hz across the complete frequency range of 2.4 GHz ensures adequate resolution to characterize narrow band communication systems and components.

RF Output

Output levels up to +25 dBm (+19 dBm above 1.2 GHz) can be set with a resolution of 0.1 dB over the entire range. An attenuator hold function allows control of the RF output without introducing RF level dropouts from the step attenuator to facilitate testing of receiver squelch systems. Also included are five RF level offsets which enable the user to calibrate out any path losses or small gains up to 5 dB.

50 W Protection

An electronic trip protects the generator output against reverse power of up to 50 W from source VSWRs of up to 5:1, preventing damage to output circuits if an RF transmitter or DC power supply is accidentally applied to the output connector. This feature contributes to long service life and low cost of ownership.

3002 VXI Signal Generator



Modulation

Comprehensive amplitude, frequency, phase, FSK and pulse modulation facilities are provided for testing all types of receivers.

Modulation Oscillator

An internal modulation oscillator is provided which is capable of generating one or two tones in the frequency range of 0.01 Hz to 20 kHz. As an alternative to a sine wave output, a triangular or square wave output is provided. A front panel input enables an external modulation signal to be combined with the internal modulation to simplify the testing of complex receiver systems.

Frequency and Phase Modulation

With a 1 dB FM bandwidth of 100 kHz and a deviation range of 0 to 100 kHz, the 3002 signal generator offers wide frequency modulation capability. AC or DC coupled FM can be selected with very low carrier frequency error and drift in the DC coupled mode. The DC coupled mode is ideal for testing tone and message paging equipment accurately. The phase modulation is ideal for testing narrow band analog radios with a deviation range of 0 to 10 radians and a 3 dB bandwidth up to 10 kHz.

Amplitude and pulse modulation

Amplitude modulation with a 1 dB bandwidth of 30 kHz and modulation depths of up to 99.9% with a resolution of 0.1% ensures the generator is suitable for testing AM systems and undertaking EMC immunity measurements. The pulse modulation facility has an on/off ratio of better than 45 dB up to 1.2 GHz and a rise time of less than 10 μ s enabling

characterization of TDMA or TDD bursts in RF amplifiers and modules.

2 and 4 level FSK

In addition to the analog FM facilities, the 3002 signal generator allows the generation of 2 and 4 level FSK signals from external logic levels. The FM deviation generated is set by programmed command. The facility is ideal for testing paging receivers and RF modems.

Sweep

When configured as a swept carrier frequency generator, the start and stop frequency, step size and time per step can be programmed along with a choice of linear or logarithmic sweep. The sweep can be set to single or continuous operation and can be initiated by a command, a trigger applied to the front panel input or from the VXI backplane. A single step facility is also provided.

Size and weight

The 3002 occupies only 2 slots in a C-size chassis. This space saving is especially valuable in the testing of FDM links where large numbers of sources are required.

Spectral Purity

Measurement of receiver selectivity and ultimate signal to noise ratio requires good spectral purity. The 3002 has a low residual FM of typically 3 Hz and sideband noise of -121 dBc/Hz at 1 GHz to allow demanding measurements to be made at an affordable cost.

Instrument stores

The 3002 signal generator provides extensive storage facilities for simplifying repetitive test scenarios. Up to 100 carrier frequency values and 100 complete instrument settings can be stored. All of these stores are non-volatile. A software protection system ensures that the stored settings cannot be accidentally overwritten. The use of an electronic storage medium without back-up batteries ensures long storage lifetime and avoids periodic replacement of batteries. A large volatile storage system capable of storing 100 instrument settings is also provided for use by automatic test systems. The values can be downloaded and then recalled by store number to avoid the time overhead introduced by the handling of the message based protocol of full instrument settings.

Sequencing

A software facility allows sequences of stored instrument settings to be defined. The trigger commands, front panel or backplane triggers, can then be used to cycle through the sequence of settings to give the highest throughput rates in automatic test systems.

Calibration Data

All alignment data, including the internal frequency standard adjustment, is digitally derived and realignment can be undertaken by protected functions and does not require the removal of instrument covers. Status information stored includes model type and serial number. An elapsed

time facility allows the monitoring of the number of users hours the product has been in use. With a recommended calibration interval of 2 years, ownership costs are kept low.

Programming

The protocol and syntax of the standard commands have been designed in accordance with IEEE 488.2 standard to simplify the generation of test programs.

To further assist in test program generation and debug, the current instrument setting and status can be read back.

Specification

General Description

The 3002 covers the frequency range 9 kHz to 2.4 GHz. The RF output can be amplitude, frequency, phase or pulse modulated. An internal synthesized programmable AF source is capable of generating single or two tone modulation.

Carrier Frequency

Range
9 kHz to 2.4 GHz

Resolution
1 Hz

Accuracy
As frequency standard.

RF Output

Range
-137 dBm to +25 dBm, (+19 dBm above 1.2 GHz)
0.1 dB resolution. When AM is selected the maximum RF output level decreases linearly with increasing AM depths to at 99.9% depth.

RF Level Units
Units may be programmed in μ V, mV, EMF or PD, dB relative to 1 μ V, 1 mV EMF or PD, or dBm. The output level can be normalized for 75 Ω operation with an impedance converter.

Level Accuracy

Temperature	17 to 27°C	
>-127 dBm	<1.2 GHz	<2.4 GHz
	± 1.0 dB	± 2.0 dB
Temp	0 to 55°C	
	<1.2 GHz	<2.4 GHz
Coefficient/°C	± 0.02 dB	± 0.04 dB

Attenuator Hold

Selection of Attenuator hold provides for uncalibrated level reduction of at least 10 dB without the Mechanical Attenuator operating.

VSWR

For output levels less than -5 dBm, output VSWR is less than 1.3:1 for carrier frequencies up to 1.2 GHz and less than 1.5:1 for carrier frequencies up to 2.4 GHz.

Output Impedance

50 Ω SMA female connector to MIL 390123D.

Output Protection

Protected from a source of reverse power up to 50 W from 50 Ω or 25 W from a source VSWR of 5:1. Protection circuit can be reset remotely. Tripping the reverse power protection illuminates a front panel LED and causes an interrupt.

Spectral Purity

Harmonics

Typically better than -30 dBc for RF levels up to +7 dBm.
Typically better than -25 dBc for RF levels up to 6 dBm below maximum specified output.

Non-Harmonics (offsets > 3 kHz)

Better than -70 dBc to 1 GHz.
Better than -64 dBc above 1 GHz
Better than -60 dBc above 2 GHz

Residual FM (FM off)

Less than 4.5 Hz RMS deviation in a 300 Hz to

3.4 kHz unweighted bandwidth at 1 GHz.

SSB Phase Noise

Better than -124 dBc/Hz at 20 kHz offset from a carrier frequency of 470 MHz,
typically -121 dBc/Hz at 20 kHz offset from a carrier frequency of 1 GHz.

ΦM on AM

Typically 0.1 radians at 30% depth at 470 MHz.

Modulation Modes

Internal and external modulation can be simultaneously enabled to allow combined amplitude and frequency (or phase) modulation. Pulse modulation can be used in combination with the other forms of modulation.

Frequency Modulation

Deviation

0 to 100 kHz, 3 digits or 1 Hz resolution

Accuracy at 1 kHz

$\pm 5\%$

Bandwidth (1 dB)

DC to 100 kHz (DC coupled)
10 Hz to 100 kHz (AC coupled)
20 Hz to 100 kHz (AC coupled with ALC)

Group delay

Less than 5 μ s to 100 kHz.

Carrier frequency offset

(DC coupled)
Less than 1% of the set frequency deviation.

Distortion

Less than 3% at 1 kHz rate for deviations up to 100 kHz. Typically < 0.5% at 1 kHz rate for deviations up to 10 kHz.

Modulation source

Internal LF generator or external via front panel BNC.

FSK

Modes

2 level or 4 level FSK.

Data Source

External data connected to Trigger input connector (2 level) or Trigger and Pulse input connectors (4 level).

Frequency Shift

Settable up to ± 100 kHz.

Accuracy

As FM deviation accuracy.

Timing Jitter

± 3.2 μ s.

Filter

8th order Bessel, -3 dB at 20 kHz.

Phase Modulation

Deviation

0 to 10 radians, 3 digits or 0.01 resolution.

Accuracy at 1 kHz

$\pm 5\%$ of indicated deviation excluding residual phase modulation.

3 dB Bandwidth

100 Hz to 10 kHz

Distortion

Less than 3% at 10 radians at 1 kHz modulation rate. Typically < 0.5% for deviations up to 1 radian at 1 kHz

Modulation source

Internal LF generator or external via front panel BNC.

Amplitude Modulation

For carrier frequencies < 500 MHz, useable to 2 GHz.

Range

0 to 99.9%, 0.1% resolution.

Accuracy

$\pm 5\%$ of set depth at 1 kHz for temperatures 17 to 27°C
Temperature coefficient < 0.02%/°C

1 dB Bandwidth

DC to 30 kHz (DC coupled)
10 Hz to 30 kHz (AC coupled)
20 Hz to 30 kHz (AC coupled with ALC)

Distortion

< 2.5% at 1 kHz rate for modulation depths up to

80%, and <1.5% at 1 kHz rate for modulation depths up to 30%.

Modulation source

Internal LF generator or external, via front panel BNC.

Pulse Modulation

Frequency Range

32 MHz to 2.4 GHz, useable down to 10 MHz

RF Level Range

Maximum guaranteed output is reduced to +20 dBm, +14 dBm above 1.2 GHz.

RF Level Accuracy

When pulse modulation is enabled, adds ± 0.5 dB to the RF level accuracy.

Control

TTL/CMOS compatible pulse input is on front panel BNC with 10 k Ω input impedance. A logic 0 turns the carrier off, a logic 1 turns the carrier on. Maximum input is ± 15 V.

On/Off Ratio

Better than 45 dB below 1.2 GHz, better than 40 dB above 1.2 GHz.

Rise And Fall Times

Less than 10 μ s

Internal LF Generator

Frequency Range

0.01 Hz to 20 kHz

Resolution

0.01 Hz for frequencies up to 100 Hz
0.1 Hz for frequencies up to 1 kHz
1 Hz for frequencies up to 20 kHz

Frequency Accuracy

As frequency standard

Distortion

Less than 0.1% THD at 1 kHz

Waveforms

Sine wave to 20 kHz and triangular or square wave to 3 kHz

Audio Output

The modulation oscillator signal is available on a front panel BNC connector at a level of 2 V RMS EMF from a 600 Ω source impedance.

External Modulation

Input on the front panel via BNC connector. The modulation is calibrated with 1.414 V peak (1 V RMS sine wave) applied. Input impedance is 100 k Ω nominal.

Modulation ALC

The external modulation input can be levelled by a peak levelling ALC system over the input voltage range of 0.75 V to 1.25 V RMS sine wave. High and low indications are reported as part of the instrument status when the input is outside the levelling range.

Sweep Mode

Control Parameters

Start/stop values of carrier frequency, size of step and time per step.

Sweep Time

50 ms to 10 s per step

Linear Sweep

Frequency step size of 1 Hz minimum.

Logarithmic Sweep

Percentage increment of 0.01% to 50% in 0.01% steps.

Sweep Mode

Single, continuous or external trigger.

Trigger

A trigger input is available on a front panel BNC. A step or the complete sweep may be triggered by the front panel input, VXI backplane trigger or VXI command.

Frequency Standard

TCXO

10 MHz

Temperature Stability

Better than ± 5 in 10^7 over the operating range of 0 to 55°C.

Ageing Rate

Less than ± 1 in 10^6 per year

External input

Front panel BNC connector accepts an input of 1 MHz or 10 MHz at 220 mV RMS to 1.8 V RMS into 1 k Ω .

General

VXI-bus INTERFACE CAPABILITIES

Complies with revisions 1.3 and 1.4 of the VXIbus specification for message based instruments

Logical address

Manual selection (1-254).

Device type

A16 D16 message based servant, programmable interrupter.
Protocol
Word serial IEEE 488.2
Fast Handshake not supported.

Connectors

P1, P2 (highest slot of a 2 slot allocation).

TLTRG

Used to trigger sweep mode and step memory sequences.

CLK10

Not used.

Local Bus

Not used.

ECLTRG

Not used

Peak Current & Power Consumption

	+24 V	+12 V	+5 V	-12 V
Ipm	1.2 A	1.0 A	2.0 A	0.6 A
Idm	0.1 A	0.1 A	1.3 A	0.1 A

Total Power 60 W max.

Cooling (per slot): 2.4 litre/s at 1 mm H₂O back pressure for 10°C maximum temperature rise.

BITE (built-in test equipment)

LEDs or modules front panel indicate Power OK (green), System Failure (red) and Reverse Power Protection Tripped (red).

RFI COMPATIBILITY

Complies with VXIbus revision 1.3/1.4 specifications below 1 GHz.

ELECTRO-MAGNETIC COMPATIBILITY

Conforms with VXI specifications revision 1.4, and with the protection requirements of Council Directive 89/336/EEC.

Complies with:-
EN55011 Class B CISPR 11
EN50082-1 IEC 801-2,3,4

SAFETY

Complies with IEC 1010-1, BS EN61010-1 for class III portable equipment and is for use in a pollution degree 2 environment. The instrument is designed to operate from an installation category 1 supply.

RATED RANGE OF USE

(Over which full specification is met)

Temperature

0 to 55°C

Humidity

Up to 93% at 40°C

Altitude

Up to 3050 m (10,000 ft)

CONDITIONS OF STORAGE AND TRANSPORT

Temperature

-40 to +70°C

Humidity

Up to 93% at 40°C

Altitude

Up to 4600 m (15,000 ft)

CALIBRATION INTERVAL

2 years

DIMENSIONS AND WEIGHT

Dimensions 2 slot, C Size
Weight Less than 4 kg

Versions and Accessories

When ordering please quote the full ordering number information.

Ordering

Numbers

3002

46882/226

59000/285

59000/286

46880/069

Versions

9 kHz to 2.4 GHz Signal Generator

Supplied with

Operating manual.

LabWindows/CVI® driver.

VXI plug & play soft front panel.

Optional Accessories

Service manual.



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